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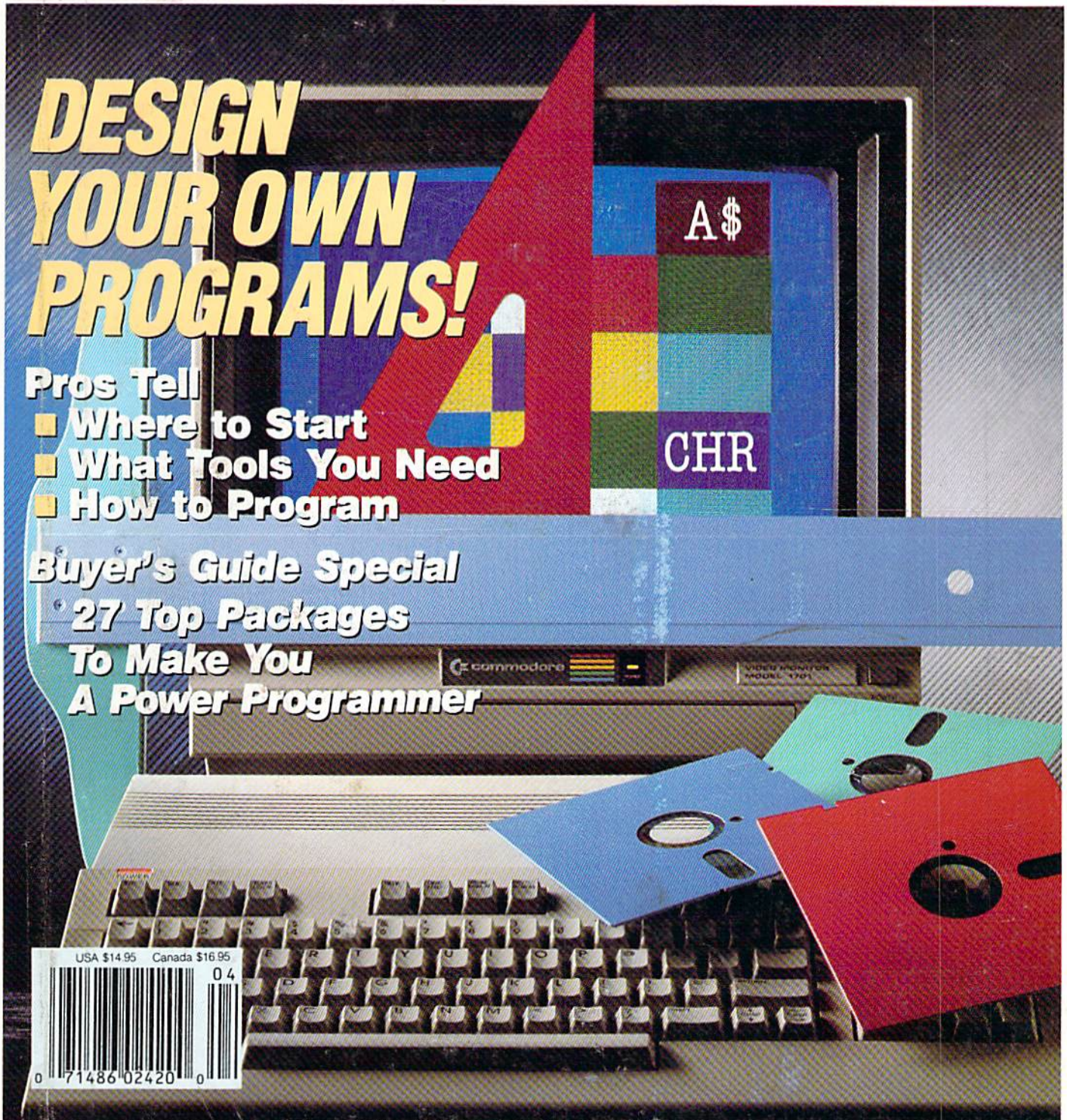

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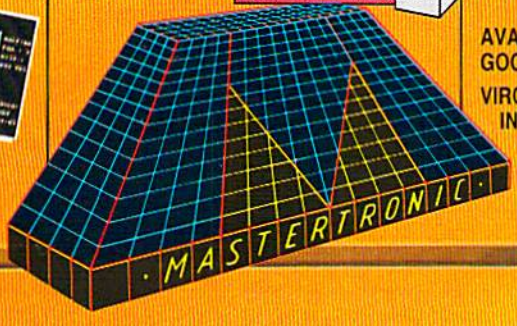

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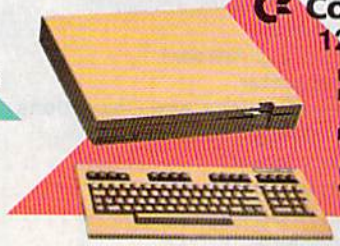

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EDITOR'S notes

The results are in. Our thanks go to the 1132 readers who sent in responses to the "Gazette Readership Survey" from the December issue. While no one would consider this survey to be scientifically accurate, we think it's a significant reflection of your general interests and plans.

Let's look at some of the more interesting results. In computer ownership, 44% of our readers said that they have 128s, 72% have 64s, and 6% have Plus/4s. The 128 percentage is a little higher than we would have guessed—up from the 38% in last year's survey. Nearly one-third (31%) of our readers own or use a non-Commodore computer. Of that group, the breakdown is PC/Tandy, 54% (many of you use them at work); VIC-20, 27% (our guess is that they're owned rather than used); Amiga, 8%; Apple II, 6%; and, finally, Mac, 6%.

In planned computer purchases for the coming year, 62% of you are staying with what you've got, while the remainder are planning to buy or considering buying primarily one of three machines: a 128, an Amiga, or a PC/Tandy. A few readers mentioned the 64 and Mac.

Last year, slightly fewer than 50% of you used GEOS, while 28% belonged to user groups. This year, 54% use GEOS, and the user-group percentage is identical to last year's number. Also similar to last year's survey results are types of software purchased in the last year. By far, the top two choices are games (60%) and word processors (56%). Only 5% purchased no software in the past year.

We see a surprising change from last year among readers who actually program their machines: last year, 89%; this year, 77%. Our deduction: We have new readers who are new computer owners, users as opposed to programmers—a trend that's seen among the computer-owner community at large. Of those readers who do program, 85% use BASIC (up from 72% last year). Nine out of ten readers use the programs we publish in the magazine, and, of this group, 77% type them in.

Like last year's results—but somewhat ironic in light of the decrease among those who program—the section of the magazine most liked is Programming. The most regularly read column, by far, is "Feedback." The second most read column is "News & Products." We anticipated its popularity before the survey was published and converted this section to the more colorful and prominent "Commodore Clips" in the January 1989 issue. All of the other columns appear to be well read—a nice balance—which affirms our choice in mix of topics.

We're grateful to all of you who responded to the survey; we actually had a lot of fun watching the numbers change as each batch of forms came in. (Rhett Anderson and Randy Thompson, "Horizons" and "Programmer's Page" columnists, respectively, were watching to see whose column was read more. The answer is in Rhett's column this month.)

For those who took the time to write in comments, be assured that all of them have been read and well noted. Thanks again.

Lance Elko
Senior Editor

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LETTERS to the editor

Note to Readers

When writing to Gazette, *please write to the appropriate department. This helps us to expedite the mail and provide answers more quickly. Address general comments and questions to "Letters to the Editor." (For examples, see below.) For technical and programming questions or problems, write to "Gazette Feedback." If you have a problem with a program we've published, address it to "Bug-Swatter." Comments or questions regarding issues discussed in columns may be addressed to* Gazette *in care of the columnist.*

Down, but Not Out

I'm getting frustrated trying to find the 1750 RAM Expander. I ordered one from a mail-order advertiser, but it was not available. Is it still being made, or is there a parts problem as some suggest?

Joe Foley
The Netherlands

Commodore told us that the 1750 REUs are slow in coming because of a RAM-chip shortage. When the chip supply is back to normal, the 1750s should be easy to find.

Videogames and the 64

I'm saddened by the fact that companies like Sega and Nintendo have neglected the 64. I hope both companies make software for 64 users. Are there plans by these companies to publish games like *Super Mario Brothers* and *Shinobi*?

Kevin Lonergan
Merrick, NY

Nintendo doesn't need to bother. The company has its hands full in supplying software for millions of Nintendo videogame machines. In fact, Nintendo is actively licensing a number of successful 64 titles from game publishers like Epyx.

*Sega, on the other hand, has released a number of its videogames in 64 format—*Out Run, Space Harrier, *and* Alien Syndrome, *to name a few. (We've seen* Out Run, *and it's an excellent arcade game.) Mindscape distributes Sega's 64 games.*

Many of the arcade games sold for both videogame machines and personal computers—from companies like Sega, Taito, Data East, Capcom, and Konami—are translations from the popular arcade coin-ops. As far as we know, Super Mario Brothers *and* Shinobi *are not available on the 64. But if you like that style of arcade game, there are dozens of others already out there that are just as challenging and fun. Incidentally, many arcade connoisseurs feel that the 64 delivers graphics, sound, and playability better than its videocartridge cousins.*

Hammering the 64 to Death

You published a reader's comment about Commodore's lack of interest in service. Boy, did you understate it. I have a 64 and 1525 printer, both of which have been a royal pain. The printer still prints nothing except the test pattern. The last shop I contacted said they would look at the 1525 for $15 *if I insisted,* but highly recommended I junk it because they consider it a "throwaway" printer. I wouldn't wish Commodore on my worst enemy. It will provide me one moment of pleasure soon, however. I am shopping for a new machine, and as soon as I buy a replacement (not a Commodore), I'm going to take my #5 sledgehammer and smash the 64 and 1525 flat. I admire you for supporting the 64, but I think you're fighting a losing battle.

Bill Fullman
Baton Rouge, LA

We know a guy who had a bad experience with a Ford a few years ago. He'll never buy another. Others loyally buy Ford after Ford with nary a complaint. It seems the computer biz is just about the same.

On Disk, Too

In your November issue, you published a program, "Magnifier," by Robert Bixby. Can you tell me whether this is included on one of your disks? To judge from the article, this program would be very useful to a member of our family with serious eyesight limitations.

Donald G. Dunn
Berkeley, CA

One of the reasons we purchased and published this program was for the reason you state: It is very helpful to the sight-impaired. Every issue of Gazette *has a companion disk which includes all the programs found in the corresponding issue. Back issues of monthly disks are available for $15.00 each; 12-month subscriptions, for $69.95. Details may be found elsewhere in this issue.*

Take a Bite out of Apple

In January's "Editor's Notes," Lance Elko argued persuasively that Commodore must direct its strategy in a decisive direction. Interestingly, "Commodore Goes Back to School" was published just three months earlier in *Gazette.* It is that education market that Commodore is poised to collect.

With Apple's recent price increases ($2,000—IIGS, $3,000—Mac SE), Commodore should be able to woo may schools into its camp. Children like bright, pretty things, but they hate to read lots of text. An Amiga with good software can teach not only graphically, but also acoustically. Talking machines really interest young people (witness the success of *Speak 'n Spell*), and the Amiga's built-in speech capabilities are ideally suited for that purpose.

High schools and colleges are likely to be even more interested in lower-priced systems with CAD/CAM capabilities (industrial arts and engineering), spreadsheets and word processors (business classes), enhanced BASIC (computer classes), digital sound (music department), and outstanding graphics (visual arts). But Commodore must show its support and be willing to stand behind its machines.

Commodore must direct its energy to be successful, but more importantly it must be visible. Let the people know about the Amiga, not just hope for word-of-mouth advertisement. If Commodore is able to make its presence felt in the education market, home users will flock to the system for the same reason that they went to Apples *(Our kids will have an advantage because they have the same computer at home that they have at school).* Commodore must focus on the education market if the Amiga is to be the huge success it can be.

Andrew Clark
St. James, MN

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More CP/M Sources

I'm writing in response to those 128 owners who seem to be having trouble finding CP/M software. Here are some places to look:

1. Local user groups that support the 128.
2. Local BBSs. (Look for 128 or CP/M boards. Most good BBSs will list all types of BBS services in your area. You don't need a CP/M terminal program to access the CP/M boards.)
3. Dynacomp (178 Phillips Road, Webster, New York 14580) has a large collection of CP/M software for rent or purchase. They have the Piconet, CP/M User's Group, SIG/M, and Kaypro User's Group public domain series. They also have other programs listed in their catalog.
4. *WordStar, Supercalc, Wordpac,* and *MBasic* can be purchased from PDSC, 33 Gold Street, L3, New York, New York 10038, for $39 each.
5. QuantumLink has its own CP/M software section in the C128 library.
6. There is a resurgence of magazine ads for 128 CP/M software.

If anyone would like additional information, I'm willing to correspond as well as make available my collection of public domain software.

Jack Pugh
11718 Golden Blvd.
Bellevue, NE 68123

Thanks for the helpful tips.

BBS List

Do you have a list of bulletin board systems or know where I could find such a list?

Greg Goodall
Petawawa, Ontario

We don't have a comprehensive list of Commodore bulletin boards, but you'll find considerable help in our next two issues. In every May and June issue, we publish our "Guide to Commodore User Groups," a fairly extensive list of groups, many of which have bulletin board numbers listed. We split the guide into two issues because of its length: Part 1 (May) lists groups in U.S. states beginning with letters A–M; Part 2 (June) lists groups in states N–Z and countries outside the U.S.

Commodore's Plans

I'm interested in business software, hard drives, and multitasking. What does Commodore plan to do in these areas for the 64 and 128?

Gilbert Fournier
New Bedford, MA

It's no secret that Commodore is shifting its marketing efforts from the 8-bit line (64 and 128) to 16-bit computers (Amiga and IBM-PC compatibles). It will continue to make 64s and 128s as long as they sell, but ads and promotions for these machines are scarce.

We haven't heard about any new hardware peripherals for the 64 or 128 from Commodore. Third-party manufacturers like Xetec and JCT produce hard drives, and software publishers such as Timeworks, Softsync, and Spinnaker make quality business software.

True multitasking is not practical on the 64 and 128 because of limited memory and slow microprocessor speed. A simple multitasking utility, "64 Multitasker," appeared in the November 1986 issue. This program lets you run two BASIC programs at the same time. If you really need true multitasking, however, you should consider an Amiga. **G**

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COMMODORE CLIPS

NEWS, NOTES, AND NEW PRODUCTS

SPECIAL CES EDITION

Mickey McLean

Twice a year the electronics world gathers to show its wares. Although the computer exhibit at this year's winter Consumer Electronics Show in Las Vegas was dominated by Nintendo and Sega games, Commodore software publishers made their presence known.

Here's a look at some of the new products coming soon to your 64 and 128.

A Jewel from Epyx

Several new titles for the 64 were announced by Epyx (600 Galveston Drive, P.O. Box 8020, Redwood City, California 94063), but one, *Devon Aire in "The Hidden Diamond Caper"* ($29.95), drew a lot of attention.

The game puts you in the role of the savvy Devon Aire, a reformed cat burglar. Devon has been hired by the wealthy widow Crutchfield to find her priceless jewel collection. Her late husband trusted no one and stashed the jewels somewhere in the mazelike Crutchfield manor.

To find clues, you must look through 30 rooms, secret passageways, and hidden doors that conceal the mysteries of the mansion. Objects must be pushed, pulled, stacked, or collected in order to discover clues, solve puzzles, and find the gems.

In addition to the mansion's secrets, you must also avoid mutant pigmice and killer canaries, the results of Crutchfield's genetic experiments.

You have three lives to find and return the jewels them to Lady Crutchfield, but you must still find your way out of the mansion.

The Return of Commodore

For the first time in several years, Commodore made an appearance at CES. Its large booth featured mostly Amigas, including the new model 2500. Commodore also showcased its line of PC compatibles and, throughout its booth, hosted several software publishers with new products.

Camouflaged Booth

Game publisher Taito Software (267 West Esplanade, Suite 206, North Vancouver, British Columbia, Canada V7M) had hosts and hostesses dressed in military camouflage to greet visitors as they stopped to see *Operation Wolf* ($34.95). Converted from one of the top-rated coin-operated games of 1988, *Operation Wolf* is set in a steamy jungle where heavily armed terrorists are holding innocent civilians hostage. You must instigate a commando-style mission to free the hostages by overtaking captors in a weapons facility, routing them from a jungle hideout, and finally leading the hostages aboard a rescue plane.

In the game's six missions, you must overcome enemy gunboats, helicopters, armored vehicles, and enemy soldiers. Sound effects include the sound of rotor blades and staccato bursts of gunfire.

Ninjas in Tandem

Activision (Mediagenic, 3885 Bohannon Drive, Menlo Park, California 94025) introduced the sequel to *The Last Ninja* at Winter CES. *Last Ninja 2* ($34.95) continues the original story line after the defeat of Shogun Kunitoki, a samurai master who has eliminated the entire brotherhood of the White Ninjitsi except one—the Last Ninja.

The sequel takes you from the shogun's domain in Japan to the streets of Manhattan, where you must destroy the samurai master Armakuni. In order to succeed, you must use martial arts skills to defeat the corrupt members of New York's police force who protect the villain.

There are seven levels to battle through, including Central Park, the street, the sewers, the mansion, the high-rise, and the Inner Sanctum. The city features mazes to explore, puzzles to solve, and enemies to fight, including the samurai master's henchmen and a dangerous leopard. Your ninja is equipped with an arsenal of weaponry including swords, staffs, nunchakus, and a shuriken.

Taito drew a lot of attention with Operation Wolf.

COMMODORE CLIPS

NEWS, NOTES, AND NEW PRODUCTS

Magic Man Hits Computer Courts

In keeping with the recent trend of sports-superstar endorsments, Virgin Mastertronic (711 West 17th Street, Suite G9, Costa Mesa, California 92627) announced that "Magic" Johnson of the world-champion L.A. Lakers will endorse its upcoming basketball game under the Melbourne House label.

Magic Johnson's Basketball will be a translation of the new arcade coin-op, *Magic Johnson's Fast Break*. Johnson not only contributed his name to the product, but also provided commentary on style and technique during the development process.

The game features seven rounds of two-on-two play and then a final round where you face Magic himself. You can execute plays such as the pick 'n' roll, alley-oop, slam dunk, and fast break.

Quality Joysticks for Less

Camerica (230 Fifth Avenue, New York, New York 10001) announced a new line of inexpensive joysticks for the Commodore 64 and 128. Each of the low-cost models features the popular pistol-grip design used in arcades. The Magnum ($7.99) and the Warrior ($7.99) have bubble switches, while the Dragon ($9.99) has a combination of bubble and micro switches. The Micro Master ($15.99) has all micro switches.

Futuristic Role Playing

Infocom (125 CambridgePark Drive, Cambridge, Massachusetts 02140) claims to have produced the largest computer role-playing game available. *BattleTech* ($39.95) has a geography of over 4 million locations.

The story line places you in the role of Jason Youngblood, who must battle against the Kurita warriors. His father, the legendary BattleMech warrior, led a squadron to meet the enemy but has never returned. In addition to saving the planet, you must also find your father.

Animated out-takes display emotional responses of the characters and zoom in on the battle-action sequences.

You can also sharpen your battle skills by visiting The Arena, which can help you build up your cash and practice your skills as a Mech warrior. As the game progresses, the battles become more frequent and deadly. Should you not want to fight a particular battle, an intelligent program in the game fights it for you.

Arcadia from EA

Electronic Arts' (1820 Gateway Drive, San Mateo, California 94404) affiliate label Arcadia has introduced *Artura* ($39.99). This arcade adventure places you in the title role of High King. To defeat a horde of invaders, you must unite the chieftains of Britain under your leadership. To do this you must gain possession of long-lost sacred treasures.

You must find the missing Merdyn the Mage, who knows where the treasures are. You suspect foul play, but your only clue is that your evil half sister, Morgause, has kidnapped Nimue, Merdyn's apprentice.

To obtain the glory of High King, you must rescue Merdyn and recover the treasures.

MicroIllusions Has the Rights

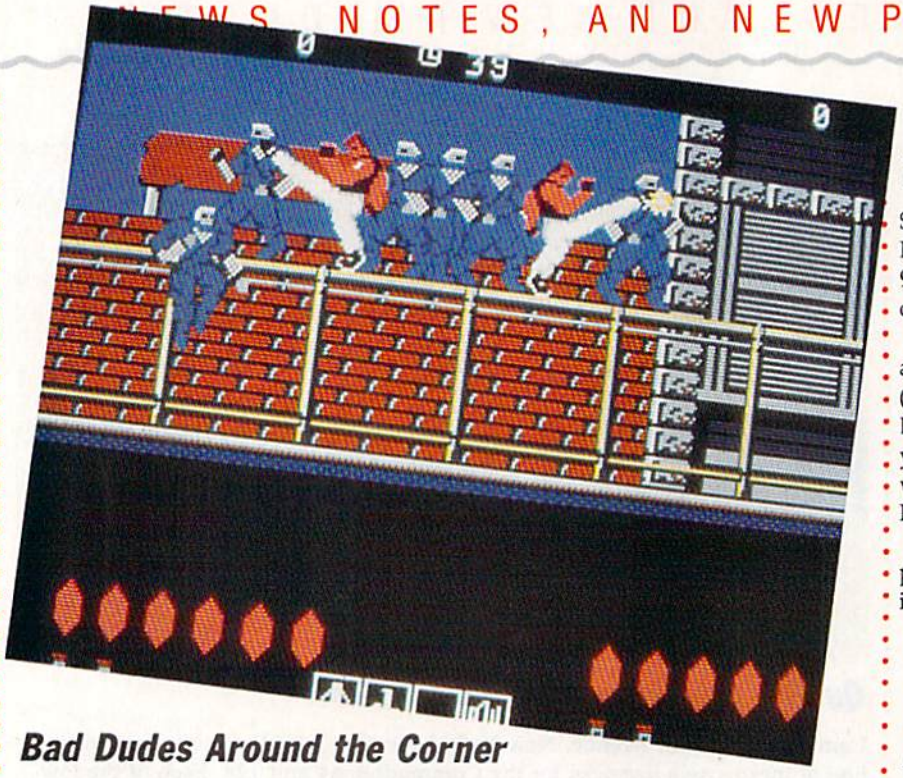
MicroIllusions (17408 Chatsworth Street, Granada Hills, California 91344) announced its purchase of the publishing rights to *Dondra—A New Beginning* ($49.95) from Spectrum HoloByte. MicroIllusions, whose products are distributed by Mediagenic, will also be producing all further installments in the Questmaster series, including the Dondra Trilogy.

The ultimate goal in the graphics-/text-adventure trilogy is to destroy the occupying evil and restore the world of Dondra to its rightful position as leader of a peaceful universe.

Players receive experience points based on attributes of play such as items gained, how the Crystal Prism was acquired, the number of times the game was saved, and the amount of time taken to complete the quest. All experience points can be transported into future *Questmaster* modules.

COMMODORE CLIPS

NEWS, NOTES, AND NEW PRODUCTS



Bad Dudes Around the Corner

Another popular coin-op that's coming to the 64 was introduced by Data East (470 Needles Drive, San Jose, California 95112). *Bad Dudes* ($34.95) features fast and furious action in the form of street fighting.

You assume the role of a modern-day hero on a mission to rescue the President of the United States from deadly kidnappers. Blade and Striker are two street fighters out to preserve good and justice. They must fight their way through waves of ninjas, dogs, and other enemies, using weapons such as knives, shurikens, nunchakus, and their fists.

Fast reflexes and the ability to stay calm under pressure are requirements in this two-player game.

Hi Tech Affiliates

Hi Tech Expressions (584 Broadway, New York, New York 10012) announced a new affiliate-label program designed to make popular software titles from a wide variety of publishers available to the mass market. Hi Tech's effort positions the company as a publishing/distribution option for developers and publishers who wish to enter the value-priced computer software market.

The company's first affiliated-label agreement is with Datasoft, a recent acquisition of The Software Toolworks. Hi Tech has shipped three Datasoft game titles already, with several more to follow.

The initial releases include *Bruce Lee*, *Conan*, and *Zorro*.

Tangled Up with Origin

Origin Systems (136 Harvey Road, Building B, Londonderry, New Hampshire 03053), through its new distributor Brøderbund, introduced *Tangled Tales* ($29.95), a fantasy role-playing adventure that casts you as a wizard's apprentice. You receive three progressively difficult tasks to perform as proof of your worthiness. The game features a world of haunted houses, medieval fortresses, and contemporary country farms. Along the way you meet more than 50 odd characters.

Tangled Tales has an easy-to-use menu and icon interfaces, and the game has a somewhat lighter theme than others in this genre.

The Force Is with Us

Star Wars is back. Brøderbund (17 Paul Drive, San Rafael, California 94903) introduced a software version of the mega-hit movie.

Based on the Lucasfilm movie and coin-op videogame, *Star Wars* ($29.95) places you in the role of Luke Skywalker as you maneuver your X-wing fighter through attack waves in an attempt to destroy the Empire's Death Star.

Your 3-D view from the cockpit provides images similar to ones seen in the movie.

A Titanic Adventure

IntraCorp (14160 SW 139th Court, Miami, Florida 33186) showed the new Capstone adventure simulation, *Search for the Titanic* ($34.95).

The world's most famous shipwreck is now on the computer screen with the challenges, dangers, excitement, and realism of scientific underwater exploration. The game was reviewed for accuracy by staff members at the Woods Hole Oceanographic Institution, the organization that first discovered and photographed the *Titanic* wreck. The program contains digitized pictures from the actual photos of the *Titanic*, taken at a depth of more than 12,000 feet.

You begin as an inexperienced oceanographer searching for the wreck of the *Titanic*. To build your reputation as an explorer, you must gain points for finding and exploring other lost vessels and earning the resources necessary for a *Titanic* search.

Search for the Titanic features over 100 navigational maps and charts, 47 ports of call, realistic weather patterns and currents, sonar, magnetometers, underwater cameras, and minisubs.

Once you've discovered the ship and its treasures, you are rewarded with the digitized pictures of the wreck site. **G**

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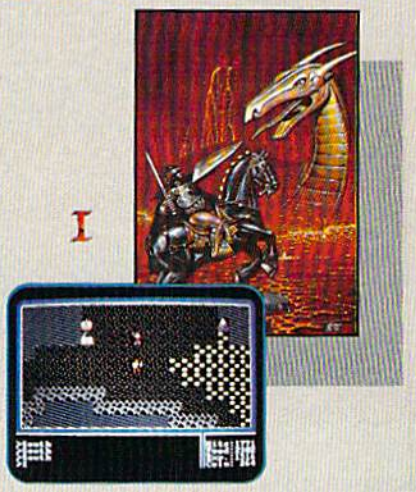
I · II · III



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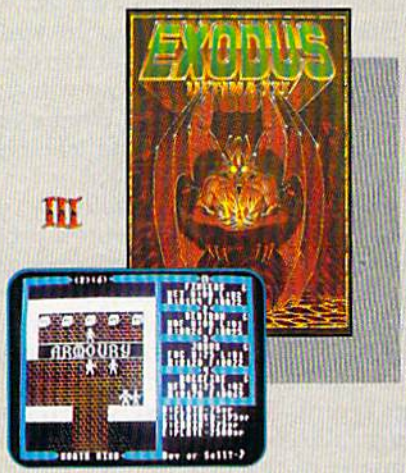

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Designing Your Own Programs

Rhett Anderson
and
Randy Thompson

Take complete control of your computer—program it! Two veteran programmers discuss the tools and the methods of the trade.

Programming is an excellent hobby. It's fun to make your computer do what *you* want it to. However, when it comes to writing a complete program, it's time to step back and think about your goals. How will you go about writing the program? What tools will you use? What steps will you take on your way to completing the project?

Some programmers follow a certain procedure each time they write a program. They might have learned the steps from a book or a programming class, or they might have picked up certain habits as they taught themselves how to make a working program. Other programmers just sit down and start typing. Even these programmers, though, already have many of the necessary elements of the program in their heads before they begin. We'll take a look at several programming strategies. If you're a beginner, you'll find out what considerations are common. If you're an intermediate programmer, you'll learn how to tackle larger projects. And if you're an expert, you may benefit by analyzing your own strategies.

Coming Up With an Idea

This is where most people get stuck. It's not enough to come up with a hazy idea of what kind of program you want; you need to define exactly what you're out to accomplish. Many successful programmers do this in their heads, but it can be helpful to write down a specific plan of attack. This may include a complete specification for a program. Drawing sample screens and planning sound effects can also help.

Many times you'll come up with an idea when you're investigating the capabilities of the machine. You might, for example, be reading about the VIC-II video chip in *Mapping the 64* and think of a great new technique for scrolling the screen. Then you might think of a program that would take advantage of this technique. Add a few things you've learned about rotating sprites, and you might have a complete program.

Sometimes you can get stuck because you know the limitations of the machine. Getting ideas from less computer-literate friends can expand your horizons. Their thoughts aren't limited to eight sprites, three sound voices, 64K of RAM, and 16 colors.

Take clues from other media. The next time you watch *Tron* or *Star Wars*, or the next time you watch the nightly news, try to get ideas that would make for a good program.

The best audience for your ideas is you. If you find that you need a certain utility while you program or if you think you have some great ideas for a word processor, write it yourself. If you need it, maybe other people do, too. Necessity is the mother of invention, after all.

If all else fails, give your subconscious a try. Many great game ideas have come from dreams. Keep a notepad and pencil at your bedside, just in case.

Keep in mind that not all ideas are practical or even possible. What may be a unique and interesting concept may prove impossible to implement on a microcomputer such as the 64. Often, however, ideas can be scaled down to fit within the confines of the machine. And if you're designing a utility, be sure that you're not just creating a solution for which there is no problem.

Choosing a Language

Although it's theoretically possible to write a program in almost any language, some languages are best suited to particular types of applications. (You wouldn't want to write a game in COBOL.) For most purposes, BASIC will suffice. You can even use a BASIC compiler like *BASIC-64* from Abacus to speed up your efforts. For more advanced programs and fast-action games, where speed is critical, machine language is probably the best choice.

Commodore 64 and 128 owners are fortunate that their computers can run a variety of languages. Available programming languages include BASIC, assembly (or machine) language, FORTRAN, COMAL, PROMAL, Pascal, C, Ada, and a few others. BASIC and assembly language are the most popular languages for 8-bit Commodore computers for several reasons. Both languages are built into the computer. If you plan on writing a program for publication in a book or magazine, you should probably use one of these two languages. You can, of course, use any language if you're writing software for your own use.

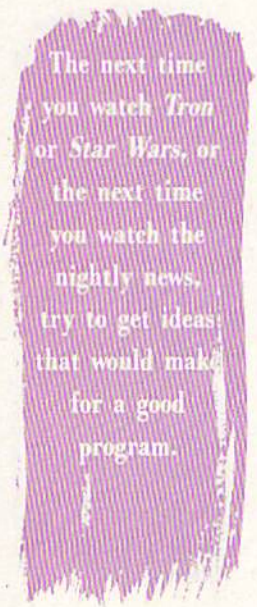
Tools

Programming utilities make life easier. Cross-reference programs, debuggers, machine language monitors, and BASIC extensions that add helpful editing commands all have their place. With the right tools, you can cut your programming time in half.

Some utilities can be used with several languages. *SYSRES* (from Solidus International), for example, can be used to edit 64 BASIC or assembly language text files. *Gazette*'s own "MetaBASIC" can aid in editing BASIC programs and assembly language programs written in *PAL* or *Buddy-128*. Sprite editors, character editors, and sound editors are all vital programming tools. *Gazette* has published several such editors.

If you choose to write your program in BASIC, you may consider purchasing a cross-reference utility such as *X-Ref 64*, from Abacus. This type of tool evaluates your program and creates printouts that list program variables and line-number references—an invaluable tool for debugging. You might also consider using a BASIC editor enhancer such as *SYSRES* or MetaBASIC. These utilities offer trace commands that allow you to track program flow.

No assembly language programmer should be without a good machine language monitor. If you can find one, try to get a monitor that allows you to single-step through your program.



If you're using another language, like Pascal or C, you can use the tools and utilities provided with the package.

Decisions, Decisions

Once you have your idea straight and your programming environment fine-tuned, it's time to start making hard choices. Like it or not, there are certain restrictions that every programmer must face. These include time restraints, hardware limitations, and the limitations of your abilities and experience. If you try to tackle too tough a job too early in your programming career, you're bound to get frustrated. Back off and try something a bit less challenging.

Just what will be the look and feel of the program? Will your program require graphics? If so, what sort? Will you use sprites? The hi-res screen? Redefined characters? Be sure to read up on the techniques for using the graphics you need.

What about the user interface? If your program is an arcade game, you'll probably want to use a joystick. A strategy game could use either joystick or keyboard. If you're designing a productivity application, you might want to consider using a mouse, pull-down menus, and windows. The added effort will make the program easier to use and much more visually appealing.

To find out whether your program is intuitive, get an inexperienced computer user to test it. People who are unfamiliar with computers will do things you'd never think of. It's important that anyone be able to use your program. To help make this possible, you should think about adding descriptive error messages and help screens. One well-written help screen can replace pages of documentation.

Organize

When you're ready to write your program, you must decide exactly how it will be organized. Most programmers break their code into subroutines or subprograms, where each subsection performs a specific task. These sections can be tested independently prior to being glued together into a complete program.

How you execute each section is very important. Some parts may need to be written in machine language for speed. Others may be interrupt-driven, such as background music or sprite animation.

Memory organization can be critical in many 64 programs, especially those that use hi-res screens, sprites, or redefined character sets. The 4K block of memory starting at $C000 (49152) is often used for data stor-

age. If your program has to interact with a utility, keep in mind that many utilities will use all or part of this space (for example, the DOS Wedge). If your memory layout will be complicated or unusual, consider drawing a memory map showing where each memory-requiring element will go.

Over the years, many methods of program organization have been taught. Flow charts were in vogue for a while. A flow chart is a diagram of the program's logic. This is a high-level look at what the key decisions and functions of the program are.

Many programmers use pseudocode when planning their programs. Pseudocode is similar to procedural languages like Pascal and C, but it is interspersed with plain English phrases.

Now is the time to choose between top-down, bottom-up, and modular programming. In top-down programming, you first plan the overall flow of the program with a flow chart or with pseudocode. After you've finished designing the main program, you design the subroutines it uses. These subroutines might, in turn, rely upon other subroutines. Sooner or later you'll reach the bottom of the nest, where you'll have to handle all the details.

In bottom-up programming, you start by writing routines that you believe will be necessary for the program you're working on. These routines might be your low-level sound or sprite handlers. Starting from these routines, you build a program which connects the pieces.

Modular programming unites top-down and bottom-up programming. In modular programming, you define the interfaces for the routines you will need. Each module can be independently tested before it is used.

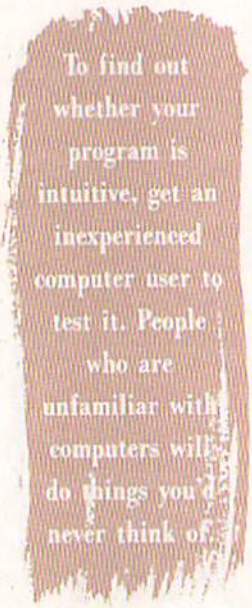
When you write a large program, you'll probably pick and choose among all of these methods. If you find yourself getting lost, try a different approach.

The Final Product

Sooner or later, you'll decide that your program is finished. Take one last look at it. You've probably solved some new problems during your ordeal. Keep the solutions (and more importantly, the methods you used for coming up with the solutions) in your head for the next program you write.

If your program is for your own use, you've finished. If it's designed to be used by a friend, or if you're selling the program, it's time to beta-test the software and write the documentation. Since you wrote the program, it will be obvious to you how each feature works. If it's not obvious to the people that beta-test your software, you'll have to make some modifications to your program or be more explicit in your instructions. Documentation is an important part of any program.

Finishing your first program is an exciting experience. And with each new program that you write, you'll find tools and techniques of your own to tackle new and more challenging problems. In the following article, you'll see how our technical editor tackles a programming problem.


To find out whether your program is intuitive, get an inexperienced computer user to test it. People who are unfamiliar with computers will do things you'd never think of.

Glossary of Terms

assembler. A program which translates assembly language source code into machine language.

beta-test. The process of testing a program, conducted by someone other than the programmer.

compiler. A program which translates the source code of a high-level language into machine language.

debugger. An environment which allows you to interact with the object code of a program. Typical features include single-stepping through the instructions of a program and analysis of the variables of a program.

DOS Wedge. A commonly used program (comes with the computer) for the 64 and 128 that allows easy access to the disk drive.

flow chart. A graphical representation of the logic flow of a program.

high-level language. A portable language, such as BASIC or Pascal, which provides abstractions that allow programmers to ignore the details of machine code.

interrupt-driven. Describes a section of program code that operates upon an interrupt.

(machine language) monitor. A program which lets you work interactively with machine language code.

memory map. A diagram which graphically depicts the memory layout used by a program.

object code. The code which is generated by a high-level language compiler or an assembler.

pseudocode. A section of code written in a combination of a high-level language and a human language.

redefined characters. Replacement definitions for one or more characters. Often used for foreign language characters or graphics on the standard text screen.

source code. Code written in a high-level language or assembly language.

Making It Work

Patrick Parrish

Writing a program, like any other task, is greatly simplified if you apply the old adage "Divide and conquer." Begin with an overall picture of what you want to accomplish in the program, and then break it into smaller, less complex bits.

We'll see how this approach works as we go about writing a sample program on the Commodore 64. And in the process, we can examine some of the important aspects of programming.

The Idea

The first step in writing a program is deciding what you want the program to do. For demonstration purposes, let's write a short BASIC game. A classic that's relatively easy to write is the game of trap.

In this game, two players are initially positioned in the middle of a play field surrounded by a border. When the game begins, the two players advance toward one another; each leaves behind a trail. The object of the game is to avoid all obstructions—your own trail, the other player's trail, and the border—for as long as you can.

Knowing what the program's going to be about, we can now organize our tools for the job. Since the program will be written in BASIC, get a copy of the programming utility "MetaBASIC" (in the February 1987 issue) if you can. You'll also want some pertinent reference books. Two excellent sources that demonstrate a number of programming techniques are *Commodore 64 Programmer's Reference Guide* and *Programming the Commodore 64*, by Raeto West.

A Procedural Outline

Before we actually start writing the program, we need to "rough it out." That is, we want to list in order the major routines that will appear in the program.

Remember: As the program develops, some routines will be added, others deleted. This is only natural, so don't worry if you don't get it right the first time. Your procedural list can and *will* change along the way. A step-wise procedure for our program would go something like this:

1. Initialize variables.
2. Set up play field.
3. Last round? If yes, then step 15.
4. Check player 1's joystick.
5. Update player 1's position.
6. Player 1 collision?
7. If so, update score and round number; then go to step 2.
8. If no collision, move player 1.
9. Check player 2's joystick.
10. Update player 2's position.
11. Player 2 collision?
12. If so, update score and round number; then go to step 2.
13. If no collision, move player 2.
14. Go to step 4.
15. End-of-game routine.

If you know how to construct a *flow chart*, you may prefer to represent the procedural outline in that form.

After you've listed the routines in the program, the project becomes a lot simpler. If you're uncertain about how you're going to write each routine, look in your reference books for similar routines in other programs. Also, magazines or books with type-in programs are helpful.

Write the Program

Since this is a game program, the most important routine in terms of the overall program development is the second one above—setting up the play field. Let's begin.

First, using a screen-memory map (found in your user's guide), draw the play field exactly as you'd envision it. The play field is surrounded by a border, except the first and last lines of the screen, which will hold each player's score. Characters representing the two players are positioned on the screen, along with a message that tells users how to start the game.

Next, using the screen diagram, write the routine that draws the play field (lines 140–260). Notice that I POKEd the corresponding color byte before POKEing each border character. This prevents a flickering effect, should the original background color be different from the color I POKEd. Also, I defined the border character and color, as well as those of the players, as variables. You could change them later with little effort—perhaps to give the game a different look.

The rest of the program grows from this routine. The listing is liberally commented with REMarks, so you shouldn't have trouble following it.

Test and Enhance

Once you have the program running, concentrate on debugging and improving it. There are a number of enhancements you can add. These include sound, redefined characters for the players, and various play options (for example, providing different speeds and randomly placing obstructions on the play field).

If you find the game a little sluggish, there are many ways that you can speed it up. First, you can define all constants in the game loop (lines 300–480) as variables. But to accomplish the ultimate, you'll have to rewrite the loop in machine language (ML).

If you're unfamiliar with machine language, a short program like this one is an ideal place to gain some experience. Start with simple routines rather than trying to write an entire program. Of course, if you take on this project, you'll need an assembler (PAL—available through Spinnaker Software—is superb) and an ML monitor ("Supermon 64"—published in COMPUTE!'s *Machine Language for Beginners*, by Richard Mansfield—is a favorite). Also, some books on ML would be handy.

See program listing on page 76. **G**

Buyer's Guide To PROGRAMMING AIDS

Caroline D. Hanlon

Serious about programming? You can make the job much easier and save a lot of time with the right tool. This guide shows what's currently available for 64 and 128 programmers.

ADA Training Course

Abacus
$39.95

ADA is the program-development language of the U.S. Department of Defense, and this package contains tools for creating programs in that language. The system includes an editor, syntax checker and compiler, assembler, disassembler, and manual.

Assembler/Monitor

Abacus
$39.95

Programmers can develop machine language programs for the 64 with this package. The assembler supports macro assembler capabilities, conditional assembly, full-screen editing, symbol-table listings, and source-file chaining. It can assemble to disk, tape, or memory. The monitor program can be used to hunt, disassemble code, transfer or compare blocks of data, access other memory banks, quick-trace with breakpoints, or perform single-step execution. The monitor and assembler programs can coexist and are both written in machine language.

BASIC-128

Abacus
Commodore 128
$59.95

BASIC-128 is a compiler to speed up BASIC 2.0 and 7.0 programs on the 128. The program can be used to manage memory, compile programs in speed code (pseudocode) or machine language, optimize FOR-NEXT loops, send commands to the disk drive, or change compiling parameters. The 128 version offers high-precision math functions and uses integer and formula optimizing techniques. The package also contains a runtime module.

BASIC-64

Abacus
$39.95

BASIC-64 is a compiler for increasing the speed of BASIC programs. The program can be used to manage memory, compile programs in speed code (pseudocode) or machine language, optimize FOR-NEXT loops, send commands to the disk drive, or change compiling parameters. The 64 version can compile BASIC 2.0 programs using the overlay feature and BASIC extensions such as *Simons' BASIC*, VICTREE, and BASIC 4.0. A runtime module is included.

COBOL-64 and -128

Abacus
Commodore 128 or 64
$39.95

COBOL is designed to help users learn to program on the 64 or 128 in COBOL. It features a syntax-checking editor, a compiler, an interpreter, a crunch function to reduce memory size, sample programs, and symbolic debugging tools such as breakpoint, trace, and single step. The program supports a subset of ANSI COBOL 74 and is available in versions for either the Commodore 64 or 128. The 128 version works in either 40- or 80-column mode. A 150-page manual is included.

Commodore Logo
Terrapin
$69.00

Commodore Logo is an active learning environment for children that can be used to teach mathematical reasoning, creativity, and problem solving. The list-processing feature can also be used with language arts. The program combines text and graphics and uses eight turtles to draw pictures and animations. This introduction to computer programming contains seven sprites, 15 colors, and enhanced music capabilities. Compatible products available from Terrapin include *Logo Works* curriculum-support materials for classroom use and *Logoware* products such as the Logo Data Toolkit. *Commodore Logo* is also available in a five-disk pack for $149.00 or a ten-disk pack for $199.00.

The Final Cartridge III
Datel Electronics
$54.95

The Final Cartridge III is a cartridge-based operating system for the 64 and 128. It features pull-down menus, windows, and more than 60 commands and functions. The Calculator accepts input from a mouse, keyboard, or joystick and enables the 128 numeric keypad to be used in 64 mode. Note Pad is a mini word processor with proportional characters. A freezer menu can be used for printing and screen dumps, killing sprites, changing a joystick to an autofire mode, protecting the computer when changing joystick ports, and backing up to tape or disk. The ML monitor does not reside in memory; it contains a sprite editor, a character editor, a drive monitor, a printer driver, and scrolling functions.

FORTH Language
Abacus
$39.95

This FORTH package contains an extended vocabulary to support graphics and sound, a built-in full-screen editor, a FORTH assembler, and a handbook. Vocabulary words can be created as needed.

geoProgrammer 2.0
Berkeley Softworks
GEOS
$69.95

geoProgrammer 2.0 is an assembly language development program that allows users to create full-scale GEOS applications. *geoProgrammer* takes advantage of icon, menu, and window interfaces. The program includes *geoAssembler, geoLinker,* and *geoDebugger.* It can be used with *GEOS64* and *GEOS128.*

JiffyDOS
Creative Micro Designs
Commodore 64 or 128
$49.95 (64)
$59.95 (128)

JiffyDOS is a serial bus ROM replacement for both the CPU and the disk drive. It is available for all Commodore 64 models and the 128, as well as most disk drives. Any computer ROM will work with any drive ROM or combination of drives, and the CPUs and disk drives can be freely mixed and matched. For heavily copy-protected programs, there is an on/off switch mounted on the computer and drive. The preprogrammed function keys are designed to work in conjunction with a directory list to the screen. Fourteen new commands have been added to the standard DOS Wedge syntax, and the commands can be used in both program and direct modes. JiffyDOS can also be used to accelerate MIDI files. It is simple to install and includes documentation and a money-back guarantee. Extra drive ROMs are available for $24.95.

Kyan Pascal/128
Kyan Software
Commodore 128
$69.95

This program is a full implementation of ISO Pascal that features command menus, help screens, and a 300-page manual and Pascal tutorial. Other features include a 6502 machine code assembler, a full-screen text editor, Pascal extensions, a built-in macro assembler, and non–copy-protected disks.

Kyan Pascal/64
Kyan Software
$69.95

Kyan Pascal/64 is a full implementation of Jensen/Wirth Pascal. The program features a standard and advanced compiler on each disk to meet the needs of programmers of all levels. It also includes a full-screen text editor, a file-management system, a standalone runtime environment, and extensions for graphics. The advanced version retains these features and also includes a machine code compiler, a built-in assembler, Pascal extensions, and an output of intermediate assembly language files.

Linear Programmer
Computer Heroes
$24.95

Linear Programmer can be used to solve linear programming problems with up to 50 variables and 35 constraints, including equality and less than or greater than. Objective (Z function) can be maximized or minimized. The solution is displayed on the screen.

MAE 64 Assembler, 5.0
Schnedler Systems
$29.95

This 6502 and 65C02 macro assembler offers a co-resident screen editor and resides with BASIC and Micromon. The assembler features conditional assembly, interactive assembly, pseudo-ops, and error checking. An 89-page manual is included. Not copy-protected.

Master-64 Development Tools
Abacus
$39.95

Master-64 is a comprehensive application-development package for screen management, indexed file management, multiprecision math, and machine language monitor. It can add 100 commands to BASIC. Features include ISAM file system, printer generation, BASIC extensions, programmers' aid, BASIC 4.0 commands, and a machine language monitor.

Menu-Driven Operating System
Cardinal Software
$29.95

With this program, disk commands can be executed by reading the menu and pressing one key, and machine code can be converted to BASIC. One-key commands include program operators such as LOAD and SAVE and disk commands such as copy, scratch, rename, format, renumber, and combine.

Merlin 128
Roger Wagner Publishing
Commodore 128
$69.95

Merlin 128 is a 128-specific macro assembler that assembles to and from the disk and supports conditional assembly. It converts integers to floating-point numbers and provides linkers to generate relocated code. The line numbers appear when the source code is listed, and the current line number is visible in edit mode. Users can also scroll in two directions when editing. The program runs only in 80-column mode. *Merlin 128* includes demonstration programs, macros, and Sourceror, a disassembler. About 35K of source code can be entered in memory at one time. The disk is not protected.

Micro Detective Automatic Error Detection
American Made Software
Commodore 64 or 128
$39.95

This debugger for BASIC on the Commodore 64 or 128 offers automatic error detection and tracing capabilities. It can find and give a reason for many errors such as syntax and illegal quantity errors. The bug-buster trace routine shows each statement as it is executed and the variables involved. You can also list the variables, files, and loops used in the program. The trace function can also be turned on or off at any time. The 128 version supports BASIC 7.0 and windows. A trace window can be placed anywhere on a 40- or 80-column screen. Each package includes a reference manual.

Pascal-64
Abacus
$19.95

Pascal-64 is an introductory-level Pascal compiler designed for the 64. The programs compile into 6510 machine language.

PTD-6510 Symbolic Debugger, 4.0

Schnedler Systems
$49.95

This transparent symbolic debugger features windows that show variables during stepping, a two-pass miniassembler, and automatic patching. It also supports high-speed driver programs for automatic conditional stepping and shows 128 prior steps. For 6502 assembly language programs. A 100-page manual is included. Not copy-protected.

Quick Brown Box

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$69.00 (16K)

Quick Brown Box is a cartridge containing 16K, 32K, or 64K of battery-backed RAM that enables users to create their own RAM cartridges of BASIC and machine language programs. The 32K version stores as many as 128 blocks; the 64K version stores 255 blocks; and the cartridge directory can hold 30 entries. With the ramdisk option, updates can be saved directly to *Quick Brown Box*. The cartridge can be partitioned for special applications, and it can be used to autoboot a disk drive. Manager programs govern creating and altering box contents. A slide switch can be used to select either 64 or 128 mode. The *Box* includes Supermon+ and a checksum program. The internal three-volt lithium battery has a shelf life of ten years. A separate utilities disk containing managers, UNNEW and KILL commands, routines, screen dumps, and a terminal program is available for $6.00.

Super C

Abacus
Commodore 64 or 128
$59.95

Super C can be used on the Commodore 64 or 128 to produce 6502 machine code. This C language development system includes an editor, a compiler, a linker, and graphics and math libraries. Source code can contain 80-character lines and horizontal scrolling. Source programs can be up to 41K in length, while object code can be 53K. Up to seven modules can be combined with the linker, and the runtime library can be called from machine language or included as a BASIC-like program. The 128 version supports ramdisks.

Super Pascal-64 or -128

Abacus
Commodore 64 or 128
$59.95

Super Pascal is a development system in versions for the Commodore 64 and 128. It includes a source-file editor, an assembler, and runtime and utility packages, plus features such as high-precision 11-digit arithmetic, overlays, automatic loading of editor and source program, error messages and localization during compilation, and statistics reporting. The system uses the Jensen and Wirth compiler and extensions for graphics. The 128 version supports an 80-column, hi-res graphics package; 1571 burst mode; and a ramdisk.

Symbol Master Multi-Pass Symbolic Disassembler, 2.2

Schnedler Systems
$49.95

This symbolic disassembler can convert 6502, 6510, undocumented opcode, 65C02, and 8502 machine language programs into source code. Coded labels are used to show the structure and flow of the program. Source-code files can be output to disk. A 63-page manual is included. Not copy-protected.

Video BASIC-64

Abacus
$39.95

Video BASIC-64 can add to BASIC 50 commands for creating graphics and sound effects. It offers a runtime version and support for dot-matrix printers.

XREF BASIC Cross Reference

Abacus
Commodore 64 or 128
$17.95

XREF BASIC Cross Reference can be used to cross-reference variables, line numbers, numeric constants, and BASIC keywords for debugging BASIC programs. The cross reference is sorted and listed to the screen or printer. Non-Commodore keywords can be cross-referenced. Programs can be read from the disk. Separate versions are available for the 64 and 128.

Xytec Macro Set 1

Xytec
$29.95

Xytec Macro Set 1 is a collection of 58 macros to speed up programming. The package offers more than 40 subroutines, over 4000 lines of code, and debugging aids. It works with DOS-compatible disks and hardware modifications such as 1541 Flash and JiffyDOS.

Publisher Names and Addresses

Abacus
5370 52nd St. SE
Grand Rapids, MI 49508

American Made Software
P.O. Box 323
Loomis, CA 95650

Berkeley Softworks
2150 Shattuck Ave.
Berkeley, CA 94704

Brown Boxes
26 Concord Rd.
Bedford, MA 01730

Cardinal Software
14840 Build America Dr.
Woodbridge, VA 22191

Computer Heroes
P.O. Box 79
Farmington, CT 06034

Creative Micro Designs
P.O. Box 646
50 Industrial Dr.
East Longmeadow, MA 01095

Datel
3430 E. Tropicana Ave.
Unit #67
Las Vegas, NV 89121

Kyan
1850 Union St. #183
San Francisco, CA 94123

Roger Wagner Publishing
1050 Pioneer Way
Suite P
El Cajon, CA 92020

Schnedler
25 Eastwood Rd.
P.O. Box 5964
Asheville, NC 28813

Terrapin
376 Washington St.
Malden, MA 02148

Xytec
1924 Divisadero
San Francisco, CA 94115

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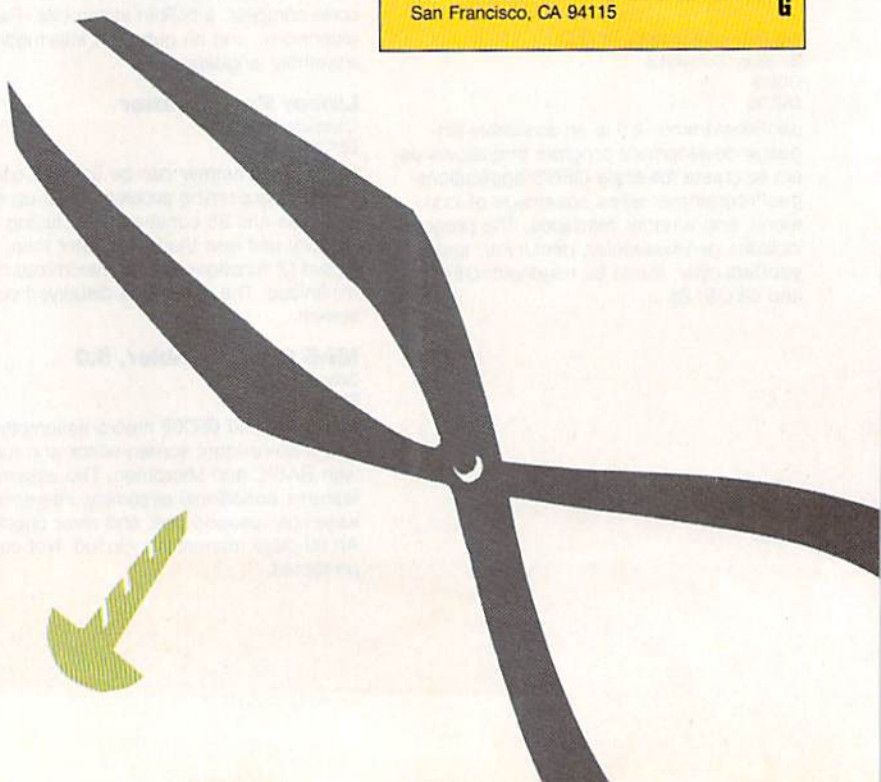

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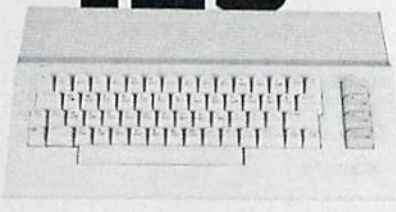

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FUTUREWARE

Science Fiction on Disk

Science fiction software is growing up. A few new releases, as well as some established classics, show just how closely some designers are coming to creating true science fiction worlds on disk.

Keith Ferrell

Distant stars and far frontiers, the edge of infinity and the day after tomorrow—these are the particular pleasures of science fiction. Many of those pleasures are now available on disk, ready to transform your 64 or 128 into a starship, a time machine, a gateway to alternate worlds.

And the best of SF software, like the best of its literary forebears, treats its material, and its audience, seriously. In modes and approaches, SF software is nearly as varied as SF is in print. There are games and simulations for nearly every taste—from adaptations of award-winning novels to recreations of the starship Enterprise, long games of galactic exploitation and conquest to rapid-fire combat on tomorrow's battlefields, wild visions of underdeveloped planets and even a few dystopias.

In short, science fiction software is a product whose time—whatever time that may be—has come.

Space Opera

Space opera is the form of science fiction most familiar to the masses—and the most popularized. The basic elements of space opera are simple: far-flung civilizations, mighty starcraft, desperate clashes for the fate of the universe. Those elements can be combined in wildly different ways: Star Trek is space opera, but so is *Dune*.

The first great software space opera was Firebird's *Elite*. With its vast galactic milieu, a surprisingly well-realized mercantile and political context, and combat that was more than just arcade action, *Elite* attracted a substantial following. It continues to delight fans and spawn imitators.

Owing much to *Elite*, although less ambitious overall, is First Row's *Star Empire*. Here you must dock with space stations, explore planets, and seek to create an empire. More arcadelike in some of its elements than the best SF software, *Star Empire* nonetheless possesses a certain charm and is worth a look.

Elite was also one of the first games to lean heavily upon documentation as a means of making its science fiction context more concrete. Context—physical setting, political and economic background, and so on—is in many ways the essence of SF.

There are science fiction games and simulations for nearly every taste—from adaptations of award-winning novels to recreations of the starship Enterprise.

Yet the shorthand conventions of print science fiction work less well in a computer game. To establish those conventions, publishers use packaging, manuals, hint books, and other external materials to heighten their products' sense of reality. *Elite*, for example, included not only a trading manual but also an adequate but unspectacular novella by Robert Holdstock, an established writer of science fiction and fantasy.

Packaged Goods

The tendency toward packaging as context has reached an extreme in the latest generation of blast-and-swerve arcade games. Many of these games now come clothed as simulations of desperate star pilots' quests to rid the universe of huge alien vessels. In reality, they are often little more than third-generation variations on *Asteroids*, *Breakout*, and *Space Invaders*—not science fiction at all.

Which is not to say that there are no legitimate SF vehicle simulations. Mirroring magazine and book science fiction, there is by now an entire category of hardware-oriented SF software. These programs put you at the controls of dream machines, tossing you into the middle of nightmare combat. While not being true science fiction—more like fantasy flight simulators—the best of these packages at least tend to have a science fiction sort of self-consistency.

Firebird's *Starglider*, like *Elite*, is accompanied by a plethora of printed material, all of it aimed at establishing a believable context from which the game's super weapons could arise.

Sir-Tech's *Deep Space* also makes clever use of packaging: The product is tucked inside a security folder that also contains facsimiles of futuristic government communiqués. (*Deep Space* wins points for adhering to the rules of physics more closely than is normal.)

Echelon, from Access, added an audio element to spacecraft piloting by including the Lip-Stik, a voice-activated headset microphone. While Lip-Stik works almost *too* well—the sigh of relief after a successful encounter can result in launching another volley of missiles—the *Echelon*/Lip-Stik combination is, along with *Deep Space*, one of the better spacecraft simulators of recent years.

Interstel's *Starfleet I* shows that you don't have to have animated graphics to deliver a superb starship simulation. Emphasis here is on systems, with more than a dozen capabilities at your command. The game's scenario is well planned, placing you in the midst of a desperate—what else?—battle against Krellans and Zaldrons, two kinds of implacable aliens who approach warfare in very different ways. Perhaps because the game places more emphasis on systems and strategy than on visuals, I found *Starfleet I* to be the most satisfying of all the space-battle simulators.

A Clone at Last

But there's more than just combat in even the most action-oriented science fiction.

With a wonderfully lurid plot worthy of an Edmond Hamilton or

Echo Satellite trail in Milky Way/U.S. Naval Observatory Photo

Jack Williamson novel of the gaudy starways, Mindscape's *Captain Blood* also manages to address one of science fiction's more serious concerns: communication with nonhuman cultures.

Captain Blood is a race-against-time story, pitting players against an inexorable clock as they search the galaxy for five stolen clones. The clones are yours, and as time passes they are draining your life force; find them or face biological degradation.

This one has a true science fiction interface. You see the game through the eyes of Captain Blood. The screen is filled with the controls of your starcraft. The joystick controls the movement of Captain Blood's hand, one finger outstretched to activate at a touch any of the ship's systems. Those systems are powerful: You can dispatch scouts, scan worlds, destroy whole planets. The ship is ready to take you, via colorful hyperspace, throughout a large galaxy filled with planets. But which worlds harbor the missing clones and which are lifeless rocks?

To find out, you must initiate a dialogue with aliens. The game begins in orbit around an inhabited world to which you must dispatch a scout. After navigating the scout by remote control through a long and winding valley—an arcade aspect that must, unfortunately, be repeated on every world you visit—you reach a landing site where, on inhabited worlds, an alien awaits.

Using an iconic language, communication ensues. Depending on its species, the alien may adopt a helpful, a hostile, or an unintelligible posture. Your responses must guide the alien toward disclosing the information you seek. It's not easy, any more than making yourself understood in a foreign country is easy. With more than 100 "words" at your disposal and a little practice, though, the iconic vocabulary becomes a flexible tool that both helps you solve the game's mystery and teaches you something about the nature of communication. *Captain Blood* is pure pulp SF: grand visions, bright colors, lunatic plot, and something to say.

Captain Blood is pure pulp science fiction: grand visions, bright colors, lunatic plot, and something to say.

Stellar Reach

No software package captures the breadth of galactic exploration and conquest as well as SSG's *Reach for the Stars*. Subtitled *The Conquest of the Galaxy*, this demanding and satisfying game challenges you to manage the expansion of your race from a single planet across dozens of worlds. Now in its third version, *Reach for the Stars* was the first of SSG's games, and in some ways it remains its most ambitious.

A couple of things make *Reach for the Stars* a standout. One is its sense of balance. Players must manipulate planetary economies and cultures in order to keep production at acceptable levels.

The game also has a sense of *size*. Its canvas is a large one, delivering the feel of galactic proportion. Where other games scatter stellar systems—or for that matter, whole galaxies—about with little consideration of astrophysical realities, *Reach* offers a believable universe with believable planets that fall into a spectrum of categories. At more advanced levels, the reality increases: Stars can go nova, natural disasters and plagues afflict civilizations, and interstellar distances become even more difficult to traverse.

Finally, there is the interface. Menu-driven, *Reach for the Stars* makes issuing complex combinations of commands easy, leaving you free to contemplate the size of your galactic undertaking. Not a game for the casual player, *Reach for the Stars* comes close to simulating the myriad variables and challenges with which Isaac Asimov, Poul Anderson, and other authors of galactic empire stories have wrestled for years.

Boldly Going

Star Trek is the most famous and long-lived space opera—*Star Wars* being not only younger but also, in my opinion, a fantasy. A full generation after they made their debut on television, Kirk, Spock, McCoy, and crew are still going strong in reruns, theatrical motion pictures, books, and, of course, on disk.

Star Trek: The Kobyashi Alternative is an interactive text adventure that gives you a surprisingly well-realized Enterprise, along with its crew and the universe through which it voyages. You assume the role of James T. Kirk, issuing orders to crew members who, thanks to a smart parser and a windowed screen, exhibit many of the characteristics of their cinematic counterparts.

Kobyashi's universe is generously populated with planets and aliens. Like most text adventures, there is a mystery at the heart of this game, and it's a good one. Interaction with aliens is well handled, as are the Enterprise's major systems.

Less effective was Simon & Schuster's second Star Trek outing, *The Promethean Prophecy*, which struck me as a pretty straightforward text adventure: all word games and little Star Trek. But fans of Kirk and company can look forward to *Rebel Universe*, also from Simon & Schuster, which will probably be available by the time you read this. (I also wouldn't be surprised if the recent and evidently ongoing success of "Star Trek: The Next Generation" resulted in a software game or two before much longer.)

Star Trek, obviously, isn't going away.

Mars

Not all science fiction fares so far from home. If there's a quintessential SF planet, in fact, it's probably our next-door neighbor, Mars. The setting for dozens, if not hundreds, of science fiction stories, novels, and movies, Mars has lately come to the 64 in Electronic Arts' *Mars Saga*.

This is not the glorious Barsoom of Edgar Rice Burroughs's Martian novels or Ray Bradbury's *Chronicles* (any of which would make a wonderful game). Rather, *Mars Saga* offers a harsh and oppressive world, one reminiscent in some ways of the frontier world Robert A. Heinlein depicted in several novels. In addition to the challenges to be faced on a new world—Mars is harsh and inhospitable, to say the least—there is the human element to contend with.

A role-playing game, *Mars Saga* requires players to assemble a team of adventurers and then guide them through various natural and manmade perils. This is a gritty, realistic game of solar system colonization. *Mars Saga* also reveals how effectively role-playing techniques, standard in fantasy adventures, can be used to create engaging science fiction experiences.

Invasion of the Book World

Science fiction writers foresaw the computer age. To that extent, it's a bit surprising that more SF writers haven't been involved in translating their works to disk or in working with publishers to create new visions on disk.

A few years ago, in fact, there was a flurry of activity, with games based on Asimov's *The Robots of Dawn*, Bradbury's *Fahrenheit 451*, and Arthur C. Clarke's *Rendezvous with Rama* appearing in a short period of time. Unfortunately, those games didn't set this world—or any other—on fire.

Lately, though, a couple of packages have indicated that SF authors may be on their way back. Several months ago, Electronic Arts released the Commodore 64 version of Thomas M. Disch's *Amnesia*.

With *Neuromancer*, SF software has taken a large step toward maturity. It shows that it's possible to to get a lot of world into a few disks.

Although not a pure SF product, *Amnesia* reflects a certain science fiction sensibility. That's appropriate enough, since Disch himself is, among other things, an excellent and controversial SF writer.

The big news, though, was Interplay's release of *Neuromancer*, a game based on William Gibson's novel of the same name. Few novels created the stir that *Neuromancer* excited upon its release. Set in a grim section of Tokyo a few decades from now, the book portrays a shadow world of computer hackers called *cyberspace cowboys*—a world full of corporate domination, greed, double-crossing, and more. So effective—if not wholly original—was Gibson's handling of his material that he became the doyen of an entire school of SF writers known as *cyberpunks*.

Interplay treated Gibson's material seriously, creating a believable and, for the most part, consistent vision of a less-than-appealing future. In doing so, Interplay has helped lay the groundwork for future SF software. [*Neuromancer* is reviewed elsewhere in this issue.]

The Future of the Future

With the arrival of *Neuromancer*, in fact, SF software has taken a large step toward maturity. It has a distance to go yet, but there are some directions already being established.

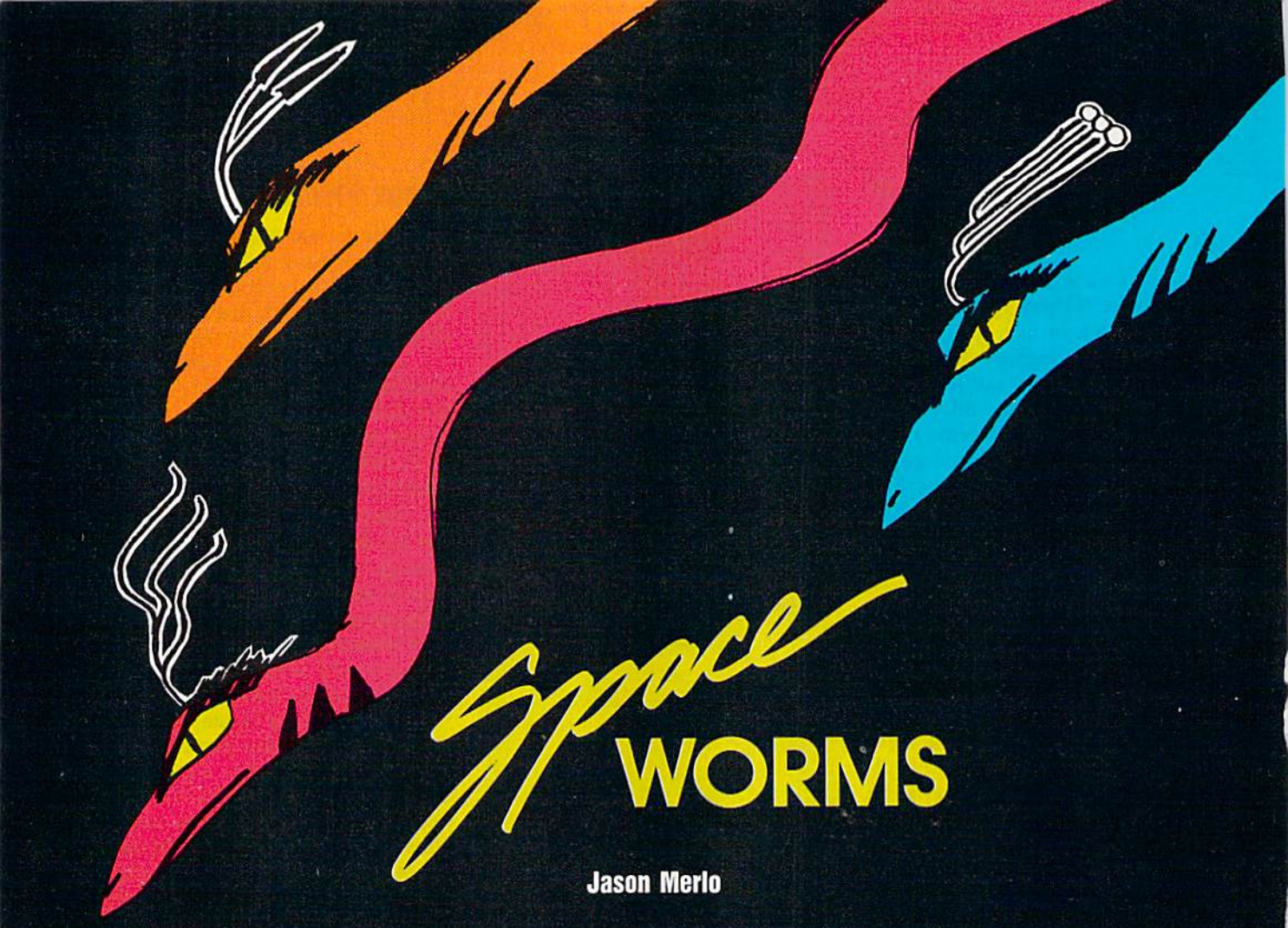
As *Neuromancer* shows, it's possible to get a lot of world into a few disks. Look for a richer science fiction milieu in products over the next few years. That richness should show up in a couple of ways.

First, we'll be seeing more context on disk, in the game where it belongs. Using databases, bulletin boards, and other information technologies as part of its background, *Neuromancer* establishes the nature of its world while the game is played, *not* while the manual is read.

Second, I anticipate a greater rigor in some of the games. *Reach for the Stars* shows that a game can take the universe and its rules fairly seriously—with occasional exceptions, such as faster-than-light travel—and still provide an entertaining experience. Much of the appeal of deep-space SF is its ability to manipulate astronomical distances and geologic reaches of time. That appeal would lend itself nicely to software entertainment.

We're already seeing a greater variety of SF software. In addition to the products mentioned in this article, recent months have seen a post-holocaust world well-represented in Electronic Arts' *Wasteland*, a twenty-first century battlefield in PSS's *Firezone*, and near-future detective work in U.S. Gold's *Techno Cop*. Obviously there is room for more types of entertainment than simply conquest games. Science fiction is a vast domain where, with a lot of research and hard work, nearly any speculation can be made believable: Look for more and larger speculations in the years ahead.

The best place to look is at the vast body of print science fiction itself. Dozens of novels and stories exist that would make perfect scenarios for software entertainment. All that's needed is an adventurous publisher or two, along with designers and programmers who understand SF's particular requirements. The audience is already there. **G**



Space WORMS

Jason Merlo

Some rather unusual and deadly aliens are coming—and it's up to you to stop them. For the 64. Joystick required.

"Space Worms" is a hypnotic shoot-'em-up game for the 64. Flying in a triangular space ship, your job is to shoot down a series of wormlike aliens while avoiding contact with their writhing bodies. If you touch a space worm, one of your five ships is destroyed.

Using a joystick plugged into port 2, you maneuver your ship and fire at the alien invaders. You may hold down the joystick's button for rapid fire, but you can have only one missile on the screen at a time. Missiles that hit the space worms disappear, so the closer you are to your target, the faster you can shoot.

The space worm's body is six segments long. Each time you hit the alien, you receive 2 points. After it has been hit four or five times, the space worm loses one segment. When the last segment (the head) is destroyed, you receive 100 points; then, after a short pause, a new and different space worm attacks.

Diving headfirst, a hostile space worm attacks.

Space worms are unpredictable. They move in semirandom patterns and their lengthy bodies flow hypnotically about the screen. To dodge the alien and position your ship for a better shot, you can move anywhere within the bottom portion of the screen. If you move all the way to the left or right, the space worms cannot reach you. It's a good strategy to hide in these safe zones when a new alien is about to attack because you never know where it will appear.

The game's current level number, your score, and the number of lives (ships) you have remaining are displayed at the top of the screen. Every time you defeat a space worm, the level number increases. At levels 5, 10, and 20, the aliens become longer—so, be on guard.

Typing It In

As with most fast-action games, Space Worms is written entirely in machine language. To enter this program, you must use "MLX," the machine language entry program found elsewhere in this issue. When MLX prompts you, respond with the values given below.

Starting address: 0801
Ending address: 1D88

Type in the data for the program. Before exiting MLX, be sure to save a copy to tape or disk. Although Space Worms is written in machine language, you load and run it just like a BASIC program.

See program listing on page 70. **G**

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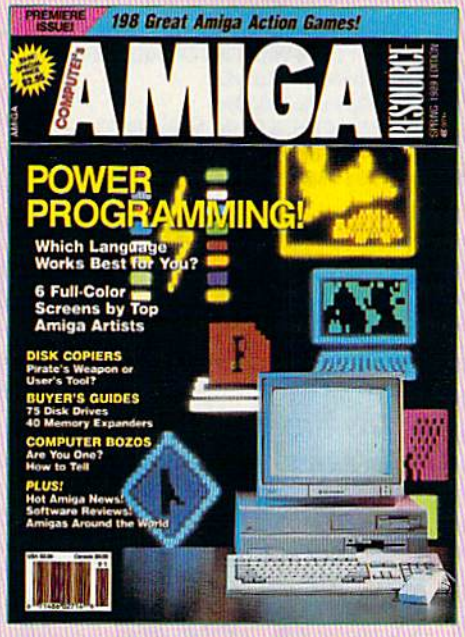

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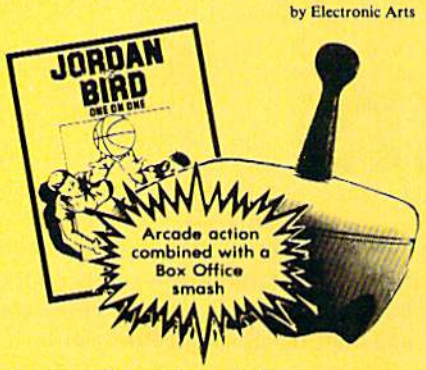

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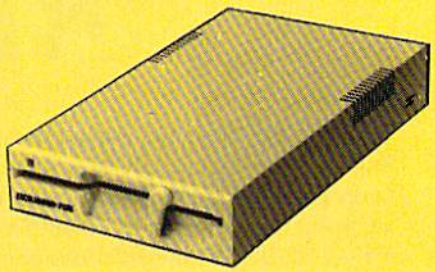

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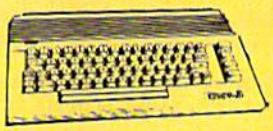

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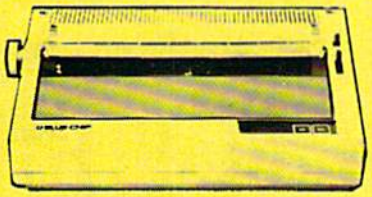

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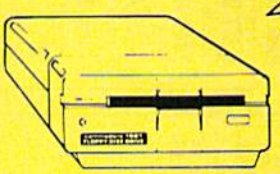

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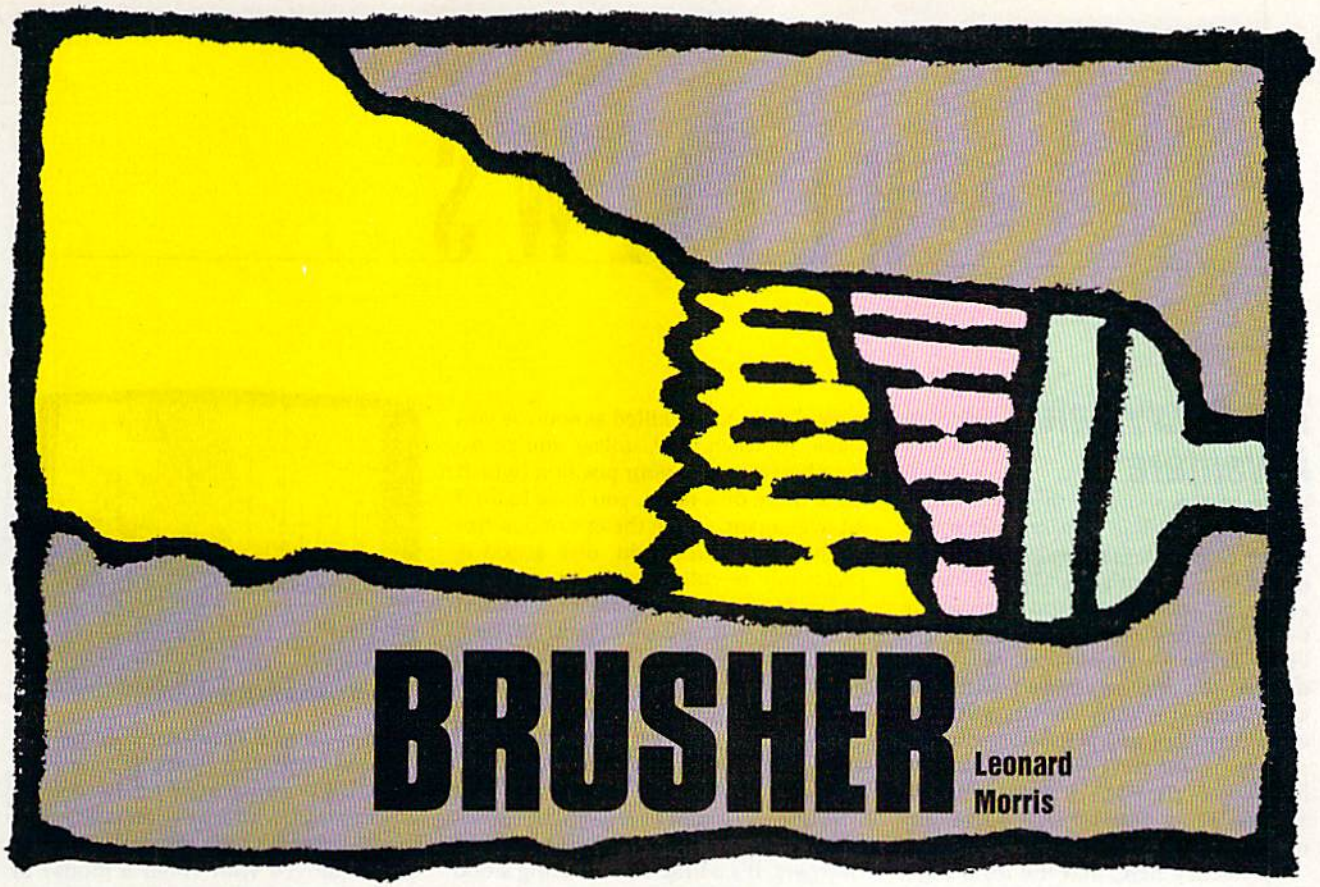


BRUSHER

Leonard Morris

Avoid the nasty Squeegees in this arcade game of paint or perish. For the 128. Disk drive and joystick required.

Ever wanted to paint the town? You can do it when you play "Brusher," an arcade-style game for the Commodore 128. You control a paint brush whose goal in life is to paint a line down every city street. Be careful—the Squeegee family has its thugs searching for you. They don't appreciate it when someone else tries to mark out their territory.

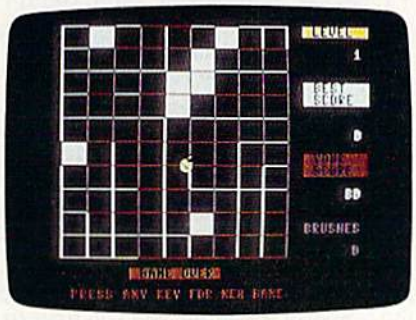
Brusher has an infinite number of levels, so you'll never master the game. On higher levels, you'll find splotches of paint that can provide temporary respite from the Squeegees.

Getting Started

Brusher is written in BASIC 7.0 and machine language. Be sure that you're in 128 mode when you enter the programs. Type in and save Program 1, "Brusher BASIC." Since Program 2, "Brusher ML," is written in machine language, you'll need to use the 128 version of "MLX," the machine language entry program found elsewhere in this issue. When MLX prompts you, respond with the values given below.

Starting address: 1300
Ending address: 19C7

Be sure to save the program to disk before exiting MLX.



Can you paint under pressure? Find out in this arcade-style game for the 128.

To start the game, plug a joystick into port 2. Then load and run Program 1. (This will load Program 2 automatically.)

The object of the game is to fill in all the blocks in the city. Do this by traversing each road. Use the joystick to move left, right, up, or down. There will be one or more of the Squeegee clan in the city. Avoid the Squeegees at all costs.

You start the game with three brushes. Each time you collide with a Squeegee, you'll lose a brush.

If you paint the whole town, you'll progress to the next level.

Beginning on level 2, you may see a splotch of paint in the city. It's a magical spot—it moves from one place to another randomly. If you can catch the splotch, you'll send the Squeegees right out of town. After a few seconds, the Squeegees will show up again at the corners of the city.

You can also chase the Squeegees out by pressing the fire button. However, you can do this only once per level. Use it as a last resort.

You score points every time you fill a city block. The score starts at 10 points per block. It increases to 20 points on the second level, 30 on the third, and so on.

On the right side of the screen, you'll find your score, the high score, the current level number, and the number of brushes you have remaining. Play well and you'll gain an extra brush after every fourth level.

See program listings on page 73. **G**

REVIEWS

The Faery Tale Adventure

We've been waiting for this for a while.

The Faery Tale Adventure was one of the earliest fantasy role-playing releases for the Amiga, and its splendid graphics and rich soundtrack made 64/128 owners wonder when it might be available for their machines. At the time of the Amiga release, MicroIllusions seemed uninterested in porting to the 8-bit machine, but economic reality soon set in and the port was on. Among followers of the 64/128 fantasy gaming market, *Faery Tale* became something to watch for.

Now it's here, and the results are, well, mixed. On the positive side, it's still the same *Faery Tale*, with graphics and soundtrack completely in tow. On the negative side, however, the port seems to be exact, and what that means is a great, great deal of very long disk access. Even those with 1571s have no escape from this problem, since only the 1541 (or 1571 in 1541 mode) is recognized.

And, yes, it's a very real problem. Even though I work with machines other than the 64, I manage to keep the speed of the 1541 in perspective. It is, after all, the only drive I used during my first three years of home computing, and it owes me nothing. But when the speed of the drive stands between a well-designed game and my enjoyment of that game, then something is wrong. What it means, unfortunately, is that the game's design did not consider the player properly. In other words, it's the designer's fault, not the 1541's.

How bad is the problem? Let's put it this way. The disk is accessed every time you enter a building, every time you exit a building, often as you're walking along (to load in the next part of the world), and most times you enter combat. Before you even leave your hometown, you have eight buildings to enter and exit, and each event takes a half-minute or so for the drive to process. This means 16 events (entry and exit for each building) and over eight minutes spent sitting and staring at the disk drive's red light. Compounding the problem is the fact that you're almost certain to get killed as soon as you leave the town, and, unless you've remembered to save your position (which takes more disk time), you have to do it all over again. Given the enormous size of the *Faery Tale* world, disk access is practically relentless.

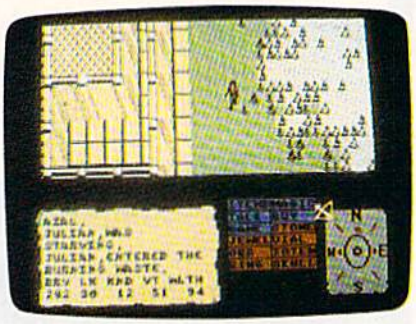
Nor would all this be a problem if you could just write the game off as a disaster and forget about it. But *Faery Tale* isn't that easy to get rid of. It is a truly excellent game, and you'll find yourself drawn back to it again and again. But then the 1541 strikes again, and once more your enthusiasm will dwindle. A continual renewal of excitement, followed by a continual series of downers. It's a little bit like being stood up by Kim Basinger on eight consecutive Saturday nights.

What about the game itself? First, it's fantasy role-playing. You control one of three brothers—Julian, Phillip, and Kevin—whose father has died after explaining how they can help rid their town of a necromancer's evil. An ancient prophecy tells of seven quests that must be undertaken to defeat the necromancer. Finding a weapon to destroy him is the first; locating his stronghold is the second; passing each interior barrier, the third; and retrieving the town's protective talisman, the fourth. During the course of the game, you will have to discover the other three.

A truly excellent game marred by a single—but major—flaw.

To achieve the quests, you must travel across the huge *Faery Tale* world. The screen gives you a 3-D overhead view (on a slight angle to show depth) of your character's immediate surroundings, and the graphics are superbly rendered. Buildings look like buildings, forests look like forests, and mountains and rivers look like mountains and rivers. When night falls, the colors are exactly right.

The bottom quarter of the screen contains an information area and a



game command area. The information area gives you your character's statistics (which are transparent to the game's functioning), while the command boxes can be accessed with the cursor, which can be moved with either a mouse or the keyboard. Using the mouse is better in this game, because joystick users must alternate between joystick and keyboard at all times.

From the command boxes, you can get an inventory of items you carry, take objects you find on the ground or on dead bodies, search areas for hidden items, give items to other characters, or use items you are carrying, including weapons, keys, and so on.

The magic menu lets you use one of seven different kinds of magic items: stones, jewels, vials, orbs, totems, rings, and skulls. Each can be used once, but others can be found. Talk lets you converse with characters, Buy lets you purchase items (including food), and the Game menu lets you pause, save, or load games.

Because of its strong graphics, *Faery Tale* approaches the magical much more closely than any other fantasy game I've seen. Two events in particular stand out. At one point you can ride on the back of a tortoise—at another, on the back of an eagle. The first speeds you considerably, and the experience is fascinating.

Riding the eagle, though, lets you fly through the air, and the view is breathtaking. The game shows very well why the ancient and medieval minds considered flight as magical, and this is a superb feat.

The game itself is extremely strong, but disk-access time almost renders it unplayable. What MicroIllusions needs to do is build a powerful fast

loader into the program and replace first editions with the new edition. Alternatively, it might consider fully supporting one of the fast-load cartridges and/or the burst mode of the 1571 drive. Until it does, *The Faery Tale Adventure* will remain underplayed by all but the truly forgiving. The game is too good to suffer such a fate.

—Neil Randall

The Faery Tale Adventure
MicroIllusions
17408 Chatsworth St.
Granada Hills, CA 91344
$39.95

Designasaurus

Once they walked the world. Now they rule the shopping malls. Everywhere you look, you see dinosaurs. Oh, no—now they've headed for the computers. Look out—it's *Designasaurus*, from Britannica Software.

Designasaurus tries to do it all. You can use it to create new dinosaurs—as if there weren't enough of those pesky little devils already. When you've finished creating your personalized monster, you can print it as a graphic (with an Epson or Commodore printer) or as an iron-on transfer to wear on a T-shirt. (Imagine the psychological insights you could achieve by seeing a custom thunder lizard emblazoned on someone's chest. Move over, Dr. Rorschach.)

The program also includes an educational game that teaches the importance of the environment and shows aspects of a dinosaur's life (eat or be eaten).

In the beginning, you're provided with a menu that allows you to choose from the Walk-a-Dinosaur game, the Build-a-Dinosaur graphics package, Print-a-Dinosaur (which sends your graphic to a Commodore or Epson printer), or EXIT (which makes the game extinct).

Let's start with Walk-a-Dinosaur. When you choose to play this game, you select the kind of dinosaur you want to be: a vegetarian brontosaurus or stegosaurus, or a carnivorous tyrannosaurus. As a herbivore, you'll be continually harassed by tyrannosauri rex (if that's the plural). These guys make the dark overlords look like a Girl Scout troop.

Whatever sort of prehistoric beast you become, you have to eat constantly. When in motion, dinosaurs use up calories faster than my old Ford LTD drank high-test. In other words, you had better find food fast.

To make your dinosaur eat, just park your brontosaurus by a tree or your stegosaurus by a bush. Every few seconds, it will consume the nearby vegetation and have to move on.

You move from left to right across the screen, and when you exit the right side, your ecosystem changes. You can also go the other way, returning to earlier ecosystems. Although it's nice to be able to move both forward and backward, there's no good reason to do so. The game is essentially two-dimensional. You can proceed in one direction or turn and run in the opposite direction. Only the line of trees and bushes closest to the screen is actually available for consumption.

The environments you experience in the various ecosystems are generally plains of temperate vegetation. Two ecosystems have lakes, and one is semiarid.

You should start out as a stegosaurus. There's a lot more vegetation in the environment suited to its palate—more so than for the brontosaurus, which specializes in tall trees (because of its long neck).

In the sky overhead, scales indicate your calorie load, the number of herbivores and carnivores in the environment, and the quality of the vegetation. For me, this was just screen clutter. The rule is eat and run. Eat constantly unless there's a carnivore on your tail, and if you're a carnivore, remember to be patient and wait for your prey to come close enough to be an easy target. If you make a premature dash, you'll end up biting the dust.

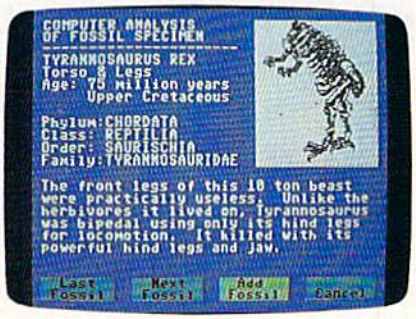
Whatever sort of prehistoric beast you become, you have to eat constantly.

If you're a herbivore, you're fortunate that the tyrannosaurus isn't a health nut. It obviously doesn't jog and can make it only about two-thirds of the way across the screen before giving up the chase and returning to its lair. No wonder it gets winded easily: It probably has a cholesterol count in the zillions, considering all the red meat it eats.

When you've successfully survived five ecosystems, you're prompted for your name (up to 11 characters), and you receive a handsome certificate of achievement.

The game is probably enjoyable for small children, but it's not for anyone over about 10. It's simply too easy, and I really question whether it teaches any lessons other than to eat constantly and to avoid large, toothy monsters—two skills kids have pretty well learned by the time they're big enough to operate a joystick.

The graphics in the Build-a-Dinosaur module are a treat. You're shown a lab and a scientist with an enormous file cabinet. With your joystick, select the part of the dinosaur you want: the head, neck, body, or tail. When you've made your selection, press the joystick button, and the scientist will kick the filing cabinet. You'll see a file on the body part you've selected. The bodies, necks, and so forth are only bones, without the skin—the way we're used to seeing them in museums of natural history.


COMPUTER ANALYSIS
OF FOSSIL SPECIMEN
TYRANNOSAURUS REX
Torso & Legs
Age: 75 million years
Upper Cretaceous
Phylum:CHORDATA
Class: REPTILIA
Order: SAURISCHIA
Family:TYRANNOSAURIDAE
The front legs of this 10 ton beast were practically useless. Unlike the herbivores it lived on, Tyrannosaurus was bipedal using only its hind legs for locomotion. It killed with its powerful hind legs and jaw.
Last Fossil
Next Fossil
Add Fossil
Dance!

The body parts aren't drawn to scale. You can fit the head of a 36-inch reptile on the body of one 60 feet long and it will look as if it belongs there.

As each body part is shown, you're given a tiny lesson about the dinosaur who contributed the bones on display. *Tyrannosaurus Rex*, it proclaims, next to a picture of the animal's cranium, *Age: 75 million years. Upper Cretaceous. Phylum: Chordata. Class: Reptilia. Order: Saurischia. Family: Tyrannosauridae.*

You're also provided with some information about the body part. Some of the facts are interesting *(The tyrannosaurus cranium was very highly developed and contained very strong, sharp teeth that were replaced as old teeth were lost)*, and some are weird *(The massive crest across the cranium [of the Corythosaurus] was probably used for mating calls).*

In all, you're provided with 6 tails, 5 bodies, 5 necks, and 11 heads. You can mix and match at will, and then print the thing (provided you have a Commodore or Epson printer). When you print the monster you create, you'll receive a short critique. It might let you know that you mixed carnivore and herbivore parts, which could be a bit confusing at mealtime.

The performance of the disk with the 128 (in 64 mode) and 1571 disk drive was spotty, erratic, and temperamental. After I'd survived a number of environments, the computer locked up in a big way. Even rebooting didn't help. I had to turn it off and let it relax for a couple of minutes before it would run *Designasaurus* again. I found this aspect of the package to be tiresome and frustrating, and I'm almost fully grown (36). I imagine it would make small children very upset. For the last

hour, I attempted repeatedly to load the program on my 128 in 64 mode. Although it had run earlier, I was unsuccessful in getting it to run again.

Each time I tried to load Build-a-Dinosaur with my 128 (in 64 mode), the program crashed. I had to run it on my 64 with 1541 drive. With that equipment, all parts of the program worked fine.

Kids love dinosaurs. Very young kids will enjoy the game. Slightly older kids will get a kick out of creating their own nightmare creatures. The addition of the certificate of accomplishment and the ability to create an iron-on are frosting on the cake. All in all, *Designasaurus* is a treat and can be educational as well.

—Robert Bixby

Designasaurus
Britannica Software
345 4th St.
San Francisco, CA 94107
$29.95

Neuromancer

Chiba City, as depicted by William Gibson in his novel *Neuromancer*, is the underbelly of the Tokyo of tomorrow. In Chiba City, you can get anything you want—for a price. Chiba City is where the hottest software manipulators of the day—the cyberspace cowboys—hang out.

Now Gibson's Chiba City and its inhabitants have been brought, appropriately enough, to the computer. Interplay has done a stunning job of translating Gibson's grim vision of the future into an animated software novel. With only a few missteps, Troy Miles and the design and programming team have created a software novel that delivers much of the impact of the original.

Gibson was not the first science-fiction writer to suppose a day after tomorrow when the ability to manipulate data, crack codes, and raid corporate databases has become a valued skill. But, in *Neuromancer* and his subsequent books, Gibson patented a distinctive cynical, antiheroical style that has attracted many followers. His books are about losers, people on the fringe, corporate titans, and a place—cyberspace, the network where all the corporate computers come together—that may be coming to life.

As a game, *Neuromancer* shares many of these qualities. The game begins in much the same way the novel does. You're a hot cyberspace jockey, down on your luck. Your deck—the computer gear you use as a gateway to the databases and, with enough power, to cyberspace itself—is in a pawn shop. You're in arrears at Cheap Hotel, where you live. Word is that someone's out to kill you. But who? And why?

The first order of business is to get your bearings and, from them, begin to build your strength, fatten your wallet, heighten the power of your deck, and erect what defenses you can against those who would kill you and sell your body parts.

Character action is determined by player-selectable icons. These tell you your current state of health and financial well-being, provide an inventory of items in your possession, and let you access the communications network (PAX), talk with other characters, walk through the world, use ROM constructs at the higher levels of the game, and access a variety of disk functions. Although tucked into a lower corner of the screen, the icons are large enough to be used easily: I had no problems with cursor control when switching among the functions. A few moments spent familiarizing yourself with the various icons will be repaid as the game progresses. Don't dally too long, though. This is a realtime game. The clock is running constantly; time and date can be checked by way of the icons as well. (If you do linger too long in one spot, you're prodded toward action by Devo's soundtrack, which makes excellent use of the 64's SID chip.)

One of *Neuromancer*'s many nice touches is the way in which the first-time player's experience corresponds with that of the game's central character. He doesn't know much more than you do, but he has certain tools at his disposal.

The size and richness of* Neuromancer*'s world help it overcome the dilemma that faces many graphics adventures.

Chief among the tools, at least at the beginning of the game, is the PAX system by which people in Chiba City keep current with news, use bulletin boards for receiving and sending messages, and manage their banking needs. PAX booths are located at various locations in Chiba City. In order to log on, you must align several items on the code wheel that accompanies the game—a neat way of making copy protection a logical part of the game's experience.

There's a PAX booth in the bar where you wake up, and it's a good idea to use it right away. Check the messages on the BBS. You should keep paper and pencil handy throughout the game to make notes of various access codes and other information that can help you get ahead.

Since you can do only so much from the bar, you'll likely soon take to the streets. Chiba City is a decadently gorgeous place to walk around, for the dominant color is, to paraphrase Gibson himself, a gray the color of a television tuned to a dead channel. (Bear in mind as you move through the world that the world is moving on as well. Keep an eye on the clock and calendar. Watch your wallet: *Everything* costs money, and a mistake can get you fined. Log onto PAX when the opportunity arises; new messages and responses to your transmissions appear constantly.)

Anything else you want to tell me?
$360
Russian arm whines as he wipes the bar. His teeth are a webwork of East European steel and brown decay.

Character movement is smoothly animated and convincing. Even repetitive gestures made by static characters have a certain charm. The designers at Interplay have endeavored to make each character reflect, at least graphically, a different personality, and, to a large extent, they've succeeded.

Not that there are many static characters in *Neuromancer*. Nearly everyone you encounter has something to tell you or sell you. The dilemma is getting the information out of them. Conversation takes the form of selectable dialogue balloons for standard replies and fill-in-the-blank balloons for seeking specific information. Again, careful notes taken here and there can help you pose the right questions at later points in the game. *Neuromancer*'s parser is pretty smart; I've had success using general terms to get specific answers.

Those answers—and the people who possess them—are scattered throughout one of the larger software worlds I've encountered. Like Lucasfilm's *Maniac Mansion* or *Zak MacCracken*, the world of *Neuromancer* seems to go on and on. Streets and sidewalks twist and turn, and alleys can be explored. You can enter stores and restaurants, penetrate high-security zones, purchase tools at hardware and software emporia, or raise cash at body-parts shops by selling excess organs. For all its

size, Chiba City is easy to get around in. On occasion, I've found myself forced to return to a different section of town and I've made the journey quickly.

The size of that world, and its richness, helps *Neuromancer* overcome the dilemma that faces many graphics adventures. While word puzzles and codes are an important part of the game, there's more here than simply trying to find an acceptable command. This is a world with which you can interact.

But the "real" world, Chiba City, pales beside the artificial universe that is cyberspace. If getting to cyberspace in the first place isn't easy, staying alive there is twice as hard. ICE—Intrusive Countermeasure Electronics—and Artificial Intelligences will do everything in their power to guard their databases from your intrusions. If you've assembled the right hardware and software tools, though, you can work your way through the defenses and begin to unravel some of the mysteries of *Neuromancer*. Be careful, though—cyberspace is more deadly than the streets of Chiba City. Watch your back. (And don't neglect to play from copies, saving early and often lest you lose the hard-won progress you've made.)

Neuromancer is not a quick game. It's best taken in stages, planning the acquisition of funds, learning your way around Chiba City, gathering as much information as possible before attempting the leap to cyberspace. Even experienced players of software narratives may have a tough time getting through some parts of this one; Interplay is currently working on a hint book to make the going easier.

Obviously, this much data takes a lot of space. *Neuromancer* fills both sides of two disks. While there is a fair amount of disk swapping, the shuttle is made bearable by the speed with which the disks load. Devo's soundtrack accompanies the title screen and sets a tone of futuristic fugue that's absolutely appropriate for this game of antiheroes, con men, and cybernetic cowboys.

Less understandable is the occasional self-consciousness that shows up in the game. Gibson's universe was notable for its grittiness and lack of sentimentality. The same is true of the software version, but the illusion is occasionally spoiled by wisecracks and jokes about other Interplay products or *Neuromancer* itself. It's as though the designers doubted the ability of their world to stand on its own and felt obliged to throw in a couple of jokes to remind us of their cleverness. This is no big deal in one sense: In a futuristic game, *Bard's Tale* references *are* cute. And the first time or two you wander into one of *Neuromancer*'s "joke" rooms, you might be amused by what is essentially a jolt of solid adolescent humor.

In another sense, though, the jokes point up one of the flaws endemic to software narratives. They lower the stakes on the table. Too many game designers don't place sufficient trust in their ability to create alternate worlds. Yet that is precisely what the best of them—and on the strength of *Neuromancer*, I would put Troy Miles and company in that category—accomplish. There is an act of faith, I believe, exercised by computer owners when they boot up entertainment software such as *Neuromancer*, and it is the same act of faith exercised when we read a book or see a movie. It says, "Take me away. Show me something I've never seen before. Let me live a life that would otherwise be denied me."

That's a lot of freight for a software game—or a novel, for that matter—to bear. But *Neuromancer*, with only the slightest and most occasional of gaffes, bears it beautifully.

—Keith Ferrell

Neuromancer
Interplay
Distributed by Mediagenic
3885 Bohannon Dr.
Menlo Park, CA 94025
$39.95

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— Guruka Singh Kalsa, Physics Engineer

CompuServe®

Heavy Metal: Modern Land Combat

Compared to war, all other forms of human endeavor shrink to insignificance. God, how I love it.

—General George S. Patton

Since old "Blood and Guts" Patton loved warfare, I think he'd have gotten a real kick out of this tank simulation from Access. *Heavy Metal* offers a taste of modern mechanized warfare on several levels, from tactical planning to swapping tank rounds with enemy gunners.

You start as a cadet in this simulation and learn to operate three modern weapon systems: the M1A1 Abrams Main Battle Tank (MBT), the Air Defense Anti-Tank (ADAT) System, and the Fast Attack Vehicle (FAV). Only after you qualify with these weapons and earn a commission will you be allowed to enter the Tactical Command Center (TACC). This is where you'll have a chance to earn promotions, depending on how well you handle yourself and your units in combat.

If you hope to avoid the wrath of General E. E. "Bud" Dink following each game's debriefing session, you'll have to learn your way around your equipment. The M1 battle tank is the most sophisticated of the three weapons and probably the most difficult to master.

The instrument screen in your tank offers more than 20 different controls and readouts, and it takes several sessions to become familiar with them all. Since some nasty fellows will be shooting at your tank, it's a good idea to familiarize yourself with the manual before you head into combat. Fortunately, the manual is clear and concise.

Your tank's Thermal Imaging System locates the enemy, and a Target Cursor appears on the main screen whenever targets move within range. This information is fed automatically into a Laser Rangefinder. Turn the tank's turret with the joystick or keyboard until your 120mm cannon is pointing at the target. Raise or lower the cannon angle with the joystick until the projectile range matches the target range. Then press the fire button to squeeze off a round. You'll see a shell arc forward and watch the target explode—if your shooting is accurate. If it's not, keep moving, make lots of smoke, and hope your armor is thick, because these targets shoot back.

The ADAT is a tank-mounted weapon designed to destroy enemy MiG fighters and TR-80 tanks. You have a bank of laser-guided missiles that are 90-percent effective against the jets. You also have a 30mm manually operated cannon that's as good as your aim against tanks and aircraft.

Graphics on this screen have a pronounced 3-D effect, featuring a desert landscape, mountains, and clouds. Tanks cross the screen as squadrons of MiGs attack your unit. There's plenty happening in this scenario, and the graphics of the attacking planes are especially good.

The action is fast and furious, and you'll need three hands to fight effectively. Two hands on the joystick aim and fire the cannon. One shell will bring down a plane, but it takes at least two well-placed hits to destroy a tank. Laser missiles lock on the jets automatically, but you'll need the third hand on the space bar to launch them. They fly realistically toward the incoming aircraft. They're effective, but you'll need the cannon's rapid-fire capability to survive.

I particularly enjoyed the ADAT. I've piled up some impressive scores, but a lot depends on your joystick. If it's worn and sluggish, you'll have a tough time lining up the crosshairs on your targets.

The third weapon in your mechanized arsenal is the FAV. It's a TOW missile launcher mounted on a dune buggy. The FAV is more of a driving simulation than the others, but there's one little catch. You can steer, but you can't brake, and the FAV's only speed is close to 100 mph. Your object is to destroy equipment and supplies as you drive through the enemy lines without crashing. Steer and shoot accurately; there are plenty of obstructions waiting to destroy your FAV.

Any of the simulations here is good enough to be sold separately.

Watch out for helicopters and incoming mortar rounds, too; you've got 99 different defense levels to penetrate—and you have only ten vehicles. This is the simplest of the three simulations, but I had a terrible time earning a decent score. It's fun to play, but I thought I'd never qualify.

Any of these simulations is good enough to be sold separately, but together they make a value-packed combination. And there's still more.

Once qualified on each of the three units, you're promoted to second lieutenant. (Scores are saved each time you play, so you don't have to master all three at one time.) Now that you're an officer, you can enter the Tactical Command Center and exercise your leadership qualities.

Several numerically superior enemy units are moving toward your headquarters. You have one each of the MBT, ADAT, and FAV units, plus a support unit of your choice. Your objective is to intercept the enemy units and defend your HQ.

As in a real battle, each unit has a limited amount of fuel and ammunition. If supplies run low, you have to pull that unit out of combat and send it back to resupply at HQ. If the enemy occupies your HQ, your supplies are cut off until you can regain control. Run out of fuel and you're out of action.

The TACC screen resembles a topographical map. Your units are on the left, next to HQ, and the computer places several enemy units on the map. When the game begins, the enemy starts moving toward your HQ. As the defending commander, you have to send units out to engage the advancing forces.

When all the units are in combat, the computer handles the fighting. You could just sit back and watch the progress, but your units probably will be defeated unless you give them a hand. Select an MBT, ADAT, or FAV unit and enter the combat yourself. Help them out for as long as you choose; then check the battle's progress. You can move your units, have them engage other enemy positions, or fall back to resupply—whatever you think is best.

Since your forces are outnumbered, don't be too discouraged if you don't win. Concentrate on eliminating as many of the enemy as you can. That's the way to gain advancement points, and your record will be saved on the unprotected disk. Earn enough points and promotions and you can even outrank General Dink himself.

Heavy Metal is fun on several levels. Play the FAV or ADAT for arcade action, or try the MBT if you want more depth of play. Strategy gamers will enjoy the TACC and the challenges it offers. I may not share General Patton's feelings about war, but I certainly get a kick out of *Heavy Metal*.

—Tom Netsel

Heavy Metal: Modern Land Combat
Access Software
545 W. 500 S.
Bountiful, UT 84010
$39.95

Caveman Ugh-lympics

We've rigged up, at great expense to ourselves, a satellite hookup to the prehistoric past. (You know, the first 15 minutes of the movie *2001: A Space Odyssey*). To justify the cost, we asked the first cave dweller we saw to review *Caveman Ugh-lympics*, a new game from Electronic Arts.

"Ugh. Need three things." (He's holding up four fingers. This could be a problem.)

"Number 1: Need sturdy joystick. No namby-pamby icon mover. Rough 'n' tough gamestick. Number 2: Need tenacity, uh . . . stick-to-it-ness. Games not that easy. Number 3: Need funnybone. *Ugh-lympics* a real tickle."

What Mr. uh . . . what Ugghhh is saying is that Electronic Arts has done it again. Apparently, some of its programmers took part in one of those zany, twisted sessions they obviously have often at EA. The result is an entertaining set of games whose entertainment value lies as much in the games' humor as in the playing.

It's 35000 B.C. and you're invited to participate in the Caveman Ughlympics. You can choose to be any of six characters who take part in six bone-crushing events: Mate Toss, Fire Making, Clubbing, Dino Race, Dino Vault, and Saber Race. You play *Caveman Ugh-lympics* much the way you play Epyx's *Winter* and *Summer Games*, with similar joystick moves. Up to six players can compete, or you can compete on your own against the computer.

Let's look at some of the games up close.

Two contestants (Thag and Ugha) sit glaring at each other in front of two piles of brush. At the signal (Ugh!) each begins rubbing two sticks together, trying to make sparks. Ugha succeeds first and starts puffing at the sparks to ignite the pile of brush. Frustrated, Thag clobbers Ugha with his club, buying time while Ugha admires the pretty stars orbiting his head. Thag now has sparks and is furiously puffing away when Ugha returns the favor with his own club.

Suddenly a wisp of smoke appears in Ugha's brush. Taking a deep breath, he delivers a blast of air to the brush pile, but nothing happens. Thag, recently back from his tour of the heavens, rubs his sticks faster. Now he has smoke, too. When a red-faced Ugha stops to catch his breath, Thag nails him again with his club.

Thag fans his festering fire into a roaring blaze and wins the Fire Making competition in a new record time of 63.5 seconds!

Next event: Mate Toss.

Gronk barks, "Come with me, woman," stepping into a rock-bordered circle.

Grabbing her by the ankles, he begins to swing her around slowly. Gradually increasing speed, he suddenly releases his grip, and she sails outward in a graceful arc—10 . . . 20 . . . 30 foots. Thrashing for all she's worth, she makes her landing approach rather like an air-thrown bowling ball. It's a three-bouncer, 33 foots. She shrugs her shoulders.

"Hold foots longer," she advises.

On his next attempt, Gronk hangs on too long, turns purple in the face, and throws only 21 foots. His mate, though groggy, gives him a thumbs-down. "Mate built like boulder," he grumbles.

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— *Greg Trotter, College Student*

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Third and final attempt. Whoosh—20, 30, 40, 50! Speed, timing, and thrashing all combine to create a toss of 59 foots and a grinning thumbs-up from his mate. Not a record, but good enough for middle rock at the awards fight. (Top rock: get knees bashed; bottom rock: get head bashed; middle rock: get both.)

Next event: Clubbing.

Two adversaries grimace at each other from opposite sides of a tall butte, a dangerous drop-off on all sides. Clubs ready, the two stomp impatiently, awaiting the start of intimidation. (An advantage here may determine the winner of the game.) At a given signal, each begins to flail and jump wildly. Gronk is startled, but stands his ground. Confused by his lack of reaction, Crudla backs up a few steps to consider strategy. Before she can formulate a plan, the clubbing begins. Gronk attacks first with a low knee bash. Crudla counters by pointing over Gronk's shoulder.

***"Graphics grade A number 1—almost like cartoon—and neat touches make for many belly laugh."*—Ugghh**

"Look, it bird!"

Gronk stops, turns, and never sees Crudla's fearsome head bash. Furious, Gronk attempts to deliver a face bop, but Crudla ducks. She points again.

"It plane!"

Gronk turns to look, not realizing planes have yet to be invented. Crudla connects with another head bash. Gronk recovers, only to find Crudla pointing behind him a third time.

"It Superman!"

As Gronk turns, Crudla strikes with a knee bash and a final overhead bash. Gronk crumples to the rock and Crudla gloats.

"Don't he know COMICS not invented yet?"

For you twentieth-century types, we'll point out that the programmers of *Caveman Ugh-lympics* have also provided a bit of prehistoric logic. Odd-numbered players—1, 3, 5—use joystick 1 (in port 2), and even-numbered players—2, 4, 6—use joystick 2 (in port 1). They also refer to disks 1–4, though there are only two disks. But we're picking nits here. (Ugghh notes that cavemen have a lot of those.)

It's only fitting that we close with a few words from our man-in-the-cave reviewer. Go ahead, Ugghh.

"Ugh! Reviewer not say much more except graphics grade A number 1 terrific—almost like cartoon—and neat touches make for many belly laugh.

"Top-notch game.

"You buy."

—Robin and David Minnick

Caveman Ugh-lympics
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$29.95

Writer 64

This fast, professional, GEOS-compatible word processor from Timeworks provides a different look, feel, and experience from *geoWrite*'s.

Anyone who uses *geoWrite* intensively and who enjoys the other aspects of the GEOS operating system will jump at the chance to work with a faster, more flexible word processor. This would be especially true for a word processor that provided the advantages of *geoWrite*—without the disadvantages of jumping back and forth on the page, losing some characters from the keyboard buffer, waiting for the screen to scroll up or down, and having to look at the fuzzy appearance of some fonts on the 40-column screen.

Some time ago, I decided that what I needed was a sort of "geoSpeedScript": a text editor simple enough for a beginner to use right out of the box, but with advanced features available in the background for those with the ambition to learn them. I wanted a word processor with the ability to perform global formatting. It also needed to be clear, manageable, and, above all, fast.

Here's an example of how this hypothetical Commodore 64 word processor could be used. Recently, I needed to set up a long manuscript to print as a booklet. I wanted the large Roma font in bold throughout, fully justified, with a header and a footer. The manuscript was only 30 pages long, but it took no less than three hours to format it the way I wanted it with *geoWrite* 2.1 for the 64.

geoWrite lacks the ability to select the entire manuscript, so you have to make global changes page by page. I had to select the page, impose the 18-point Roma font, then choose boldface, select full justification, and finally insert the page break carefully to avoid widows and orphans. Then, when I was a little way into the procedure, I had to stop and do it over again. I had forgotten to insert the header and footer, which affect the page length. Then, when I printed the first page, I discovered that I had neglected to insert an extra blank line beneath the header, making it appear too close to the body text. So I had to do it over again, readjusting the page breaks throughout the manuscript.

In the end, the manuscript looked great on paper, and I felt a warm sense of accomplishment for having stuck with a difficult task. But I had the strong feeling that there had to be a better way. Once again, I resolved to sit down with *geoProgrammer* and begin "geoSpeedScript." Someday.

Writer 64, from Timeworks, makes that forbidding project unnecessary. Not everyone will instantly fall in love with this word processor, and it does have a few serious drawbacks, but it also represents a happy marriage of GEOS and fast word processing.

The *Writer 64* screen looks different from *geoWrite*'s. When you enter text, you don't see the familiar WYSIWYG (What You See Is What You Get) screen. The text is uniformly displayed in a highly readable version of the system font. When you select a new font, type style, page width, tab, or page break, it's represented onscreen by a reverse at-sign (@). You can see the information contained in the embedded code by moving the cursor to the text. The information contained in the code will be displayed in an onscreen window.

If you've ever seen *XyWrite* (a professional word processor for the PC) in action, you'll recognize some of the philosophy behind *Writer 64*. The screen presents the text with its formatting codes, not the page as it will appear on paper. It's a throwback to an earlier, simpler time, when computers were unable to display anything but text.

If you're wedded to the WYSIWYG ideal and you absolutely must see the page as it will appear on paper, you can still do that. Simply click on Full Page and you'll be able to move all around a depiction of the printed page. You won't be able to edit, but you will see a realistic preview—which is the whole idea behind WYSIWYG in the first place.

Meanwhile, you'll be able to type as fast as you want and change any aspect of your manuscript as often as you like. If you have a global attribute to set, simply go to the beginning of the manuscript and set it there. The entire manuscript will take on that attribute, unless it's specifically overridden later in the text.

You can affect the type style and font globally (throughout a manuscript). *Writer 64* also has the built-in capability to print a final-draft–quality printout (double-printing each line on a dot-matrix printer) or a first-draft–quality printout (for a quick preview on paper).

You can't import *geoWrite* documents, and currently there's no way to translate between *geoWrite* and *Writer*

64. I find this to be a real drawback—this should be a minimal requirement of a GEOS-compatible word processor. (The package says it's *geoWrite*-compatible, but that's based on the fact that it can use the same fonts *geoWrite* can.) You can save a file as ASCII, but you'll lose all your formatting. Perhaps Timeworks will provide a translation package as an upgrade in the future. A Timeworks spokesperson told me that other users have requested this. I wouldn't be surprised to see a translation program appear on the bulletin boards.

You can't select text by dragging through it. To select text, you must select Mark from the Edit menu and then pull the selection through the manuscript with the cursor keys. The keyboard buffer is rather large—15 characters, by my estimate—so the selection can easily get away from you. You may find yourself selecting beyond the point where you want to stop and continuing up to 15 lines or characters beyond. For people who are used to mice, this will seem odd, but bear in mind that the underlying philosophy of *Writer 64* is different from that of *geoWrite*. This is a text-editing, keyboard-intensive word processor. You're sacrificing some of the glamour of *geoWrite* for speed.

One thing that I may never get used to is the limited number of options available for selected text. You can only cut, copy, or paste text. You can't change the formatting or font, for instance, as you can with *geoWrite*.

Text cut or copied from *geoWrite* into the Text Manager can't be pasted into a *Writer 64* document—*Writer 64* only recognizes its own text scraps. It will import graphics from *geoPaint*, however. The graphics scrap has to be in a Photo Manager album.

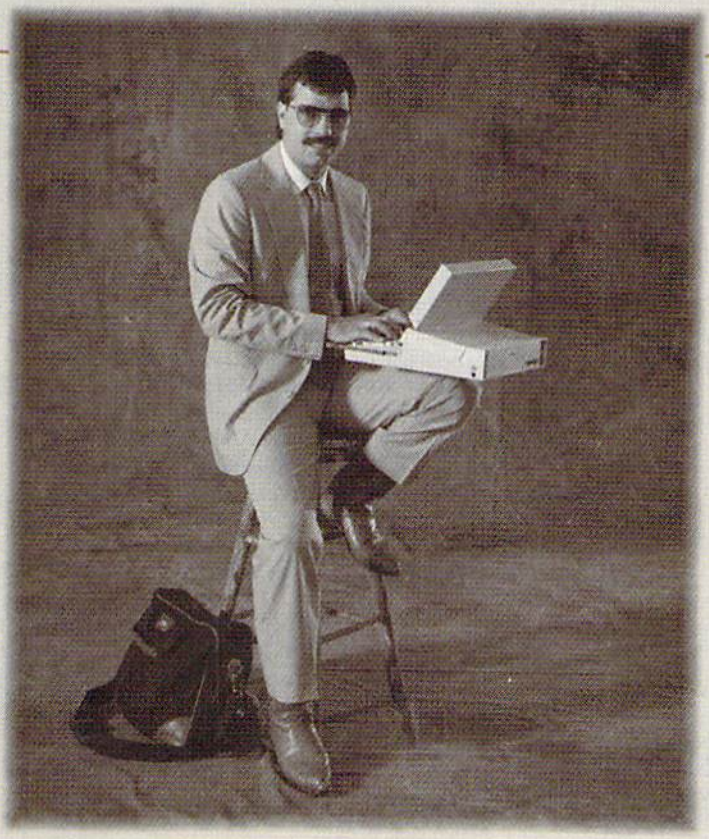
Writer 64 *trades off some of* geoWrite's *glamour for speed.*

Inserting a graphic is something of a trial, but it's also more flexible than inserting a graphic with *geoWrite*. When inserting a graphic with *Writer 64*, you'll be asked to specify its offset from the upper left corner of the page. That requires a considerable amount of preplanning. *geoWrite* will center a photo scrap on the page and automatically leave room for it. *Writer 64* will place the graphic literally anywhere on the page. If you're careless with your measurements, it will happily superimpose the graphic over the text. If you edit the text in a way that shoves it around on the page, you might ruin the graphic by putting text where the graphic should be.

Timeworks recommends that you place the call for a graphic at the very beginning of the page on which it should appear—if you place it beyond that point, it won't be printed. The company also recommends that you print out a copy of a page before inserting the graphic. That way you can measure the position of the graphic and enter the values exactly.

When I initially used *Writer 64* with a 128 in 64 mode, running from the 1750 REU, *Writer 64* had a lot of trouble with large-font *W*'s and *M*'s. They printed on paper and appeared in the page preview as smears or other weird shapes. When the product was used again on the same equipment, and on the 64 with a 1541 disk drive, this problem didn't occur. I would recommend that the program be run from the REU if possible because of the remarkable speed and flexibility it lends to virtually all phases of GEOS activity.

When the 1541 was used to edit a 3K text file, all of the action was acceptably fast except the page preview. It took nearly 2½ minutes to put a WYSIWYG display on the screen so that I could get an idea of what the document would look like on paper. It took a similar length of time to preview a reduced version of the screen (as can be done



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with *geoWrite*'s page-preview function).

When the WYSIWYG preview (which Timeworks calls Full Page) is on the screen, you can use your pointing device to move from place to place on the page. When I moved the display from the top of the page to the bottom, it took over 30 seconds to bring the bottom of the screen into view.

By using the REU, I was able to cut both of these times to just a few seconds.

You must have GEOS version 1.3 or a more recent version in order to run *Writer 64* (for this review, I used the new GEOS 2.0). Like all GEOS products, *Writer 64* performs rather slowly with the 1541; with the 1581 or 1571, it's a little faster; but with the REU, it's a rabbit.

Writer 64 can work only with files ranging to slightly longer than 7K (just over a thousand words), but you can chain files together to make up longer documents. A box in the upper right corner of the screen keeps track of the amount of space remaining. If you use up too much space, a warning will appear onscreen telling you to close this section and start another.

When writing, you'll need to be aware of the various parameters. If you're writing in bold and you temporarily switch to italics, you have to remember to turn italics off. To turn it off, select Plain and then Bold again from the Style menu. (When you select Plain to turn off italics, it turns off Bold, as well.) As you can see, this word processor requires some thought and planning.

If you move the mouse during a screen refresh, you might end up leaving the cursor in a random location. For instance, I moved the mouse pointer to a given position, clicked, and then moved it to another location at the moment the screen was being updated. During the split second it took for the mouse click to register, the cursor moved to a new location along the line of travel.

Pulling the mouse cursor beyond the top or bottom of the page does not scroll the screen. The screen will scroll (very rapidly) one line at a time if the cursor is, for instance, on the top line and you use the cursor keys to move upward. Clicking on a special set of arrows will cause the display to move up or down one page (a screenful).

Writer 64 also offers mail merge, online help, and a speller.

With mail merge, *Writer 64* allows you to merge your document with other data. You can have as many as nine fields per record, which means that you can write a form letter and leave as variables a person's name, street address, city, state, and zip code, as well as name of spouse, car make, blood type, and shoe size.

A program that concentrates so heavily on keyboard input needs a help screen to assist you in remembering all the options available. *Writer 64* provides three pages of help screens showing all the key combinations needed to run the word processor.

If you have more than one drive running, the speller has to be in the opposite drive and on a disk named SPELLING. Once you've invoked the speller, you won't be able to continue until you've inserted a disk named SPELLING. It's poor programming, but not uncommon in GEOS applications. You should always be able to back out of a decision without having to reboot.

Although the speller worked fine when the disk was in a 1571, it wouldn't work at all with the speller files on the disk in the 1581 drive or on the REU. You can't cheat by having a two-sided disk named SPELLING with both your text file and the speller in the 1571. I tried everything I could think of to get around these problems—to no avail. The speller evidently has to be on a one-sided disk in a 1541 or 1571 disk drive.

It's a relatively fast speller, even when compared to *geoSpell* running on the REU.

The speller doesn't allow you to create a personal directory. The speller dictionary is enormous, however—100,000 words. The complete speller, including this enormous dictionary,

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takes up an entire disk side.

Writer 64 is fast (even faster than *SpeedScript* when you're inserting text early in a lengthy document) and keyboard-intensive (which will be appreciated by touch typists). It's capable of formatting tricks that go beyond *geoWrite*, but you won't see the onscreen formatting unless you request a preview.

Writer 64 is not *geoWrite*-compatible, however, and it refuses to import text scraps from the text manager. *Writer 64* doesn't have what could have been its greatest strength—the ability to work as an adjunct to *geoWrite*. As a standalone word processor, it's a tradeoff of speed and convenience in exchange for *geoWrite*'s graphics interface. Mouse mashers will hate it, because the mouse (or other pointing device) plays such a small role. (You could conceivably get along entirely without a mouse once the program was running.)

Writer 64 was produced by a reputable company with a well-deserved reputation for quality software and regular upgrades. I consider it a good buy if you do a lot of word processing with your GEOS-driven 64.

—Robert Bixby

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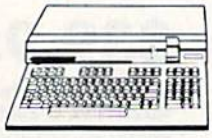

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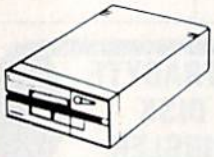

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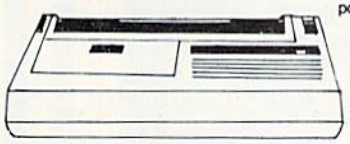

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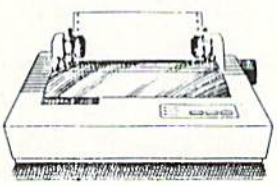

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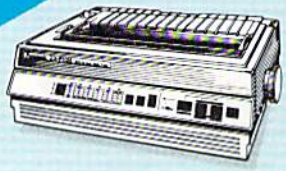

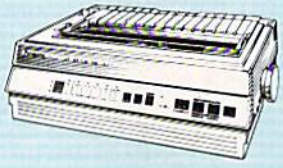

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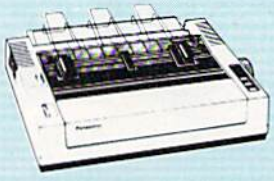

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power BASIC

Italics

Richard Penn

Through creative use of raster interrupts, this machine language routine gives you italic letters without redefining any characters. It's small and easy to use, and there are versions for both the 64 and the 128.

Italicized characters add flair and zest to text displays. They can liven up menus, help screens, and any text-based program, such as an adventure game.

You can use a custom character set to create italic letters, but designing it takes both time and energy. "Italics" cleverly uses raster interrupts and the horizontal scroll register for a quick and easy way to highlight characters. You simply run the program, and all your characters—normal, inverse, custom, and graphics—are italicized.

Getting Started

Italics comes in two versions: Program 1 is for the 64, and Program 2 is for the 128. Enter the program listing for your machine. (The 128 version works in 40-column mode only.) Both programs are short machine language routines written in BASIC loader format. Be sure to use "The Automatic Proofreader," found elsewhere in this issue, to ensure accurate typing. Save a copy of the program to tape or disk before you run it.

To use Italics, simply load and run the program. All characters displayed on the screen will become italicized. Press RUN/STOP–RESTORE to disable italics. SYS to the program's starting address (SYS 832 on the 64; SYS 4864 on the 128) to reactivate them. You may load and save other programs while Italics is active. Programs that change the interrupt vector (like *SpeedScript*) may not be compatible with Italics. Disk access causes the display to re-adjust because it disturbs interrupt timing.

The machine code for Italics is fully relocatable; simply set the variable SA in line 30 (both versions) equal to the program's new starting address. The default locations are the cassette buffer at 832 ($0340) on the 64 and in the free memory block at 4864 ($1300) on the 128.

Dual Display

You can simultaneously display normal text and italics by changing line 100. The variable IS represents the start of the italics zone in raster lines, and IE represents the end. The visible screen consists of raster lines 50–249. Setting IE equal to 156 sets the top half of the display in italics and the bottom half in normal text. You cannot get normal and italic text on the same screen row.

How It Works

The program creates italic characters by decrementing the horizontal scroll register ($D016) during raster interrupts. The 64 version decrements the scroll register every two raster lines; the 128 version decrements every four scan lines. The 128 is less efficient because it has to do more during each interrupt cycle (like checking for interrupt-driven sprites). After eight lines, the scroll register is reset to prepare for the next row of characters.

See program listings on page 68. **G**

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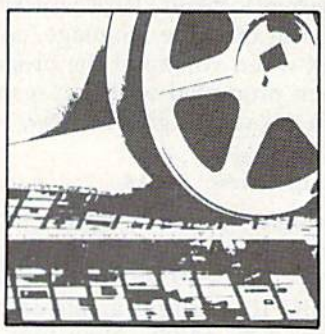

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BASIC 10

John Fraleigh

Add these ten useful commands to BASIC for improved loop constructs, advanced string handling, and dedicated joystick commands. You'll write better programs in less time. For the 64.

Programming is easier and more fun when you have a good language to work with. "BASIC 10" is an enhancer for the Commodore 64 that transforms BASIC 2.0 into a superior language. It's a great step toward learning languages like C and Pascal.

BASIC 10 includes commands for reading the joystick, string manipulation, and screen output. BASIC 10 also allows longer variable names—the first ten characters are significant. Other features include the ability to RESTORE to a line number and support of hexadecimal numbers.

Getting Started

Program 1, BASIC 10, is written entirely in machine language, so use MLX when you enter the program. When prompted by MLX, respond with the values given below.

Starting address: 0801
Ending address: 0FA8

Be sure to save the program to tape or disk before you exit MLX.

When you're ready to use BASIC 10, perform a cold start by typing SYS 64738. Now load and run BASIC 10 as you would a BASIC program. The screen border and background change to brown and the familiar power-up message appears. Notice that there are only 37,119 bytes free instead of the usual 38,911. Type the following line in direct mode to complete installation:

```
POKE 44,16:POKE 4096,0:NEW
```

This reserves the first 2K of memory, making BASIC programs start at memory location 4097 instead of 2049.

A Whole New Language

BASIC 10 is a superset of BASIC 2.0. There are many subtle differences between the two languages, so it's important to read the command descriptions before you start programming. The new commands are JOY, FIRE, INSTR$, STRING$, IF/THEN/ELSE, REPEAT/UNTIL, WHILE/WEND, HOME, CLS, and LOCATE. Programs that use the new commands will not run unless BASIC 10 has been installed. Also, remember to have BASIC 10 installed when you type in new programs. If you enter a BASIC 10 program while you're in BASIC 2.0, the BASIC 10 keywords will not be tokenized properly.

There are a few fundamental guidelines you should keep in mind when writing your own BASIC 10 programs. BASIC variables now use the first ten characters instead of the first two. A period and BASIC keywords can be embedded in the name.

```
10 BONUS.PTS = BONUS.TIME * 5
```

Keywords can be embedded in variable names. As a result, you must put a delimiter (a space, comma, parenthesis, or equal sign) after each BASIC command. The sample below uses a variable named FORT; BASIC 2.0 would interpret this as FOR T=500.

```
10 FORT=500
20 PRINT FORT/100
```

Array names are still recognized by the first two characters. They are referenced by square brackets instead of by parentheses:

```
10 DIM DX[20]
```

BASIC 10 recognizes hexadecimal numbers. Hex numbers can be used virtually anywhere that decimal numbers are used, with the exception that line numbers must still be in decimal.

```
10 READ A%,B,C$
20 DATA $C,$D020,$0400
30 POKE B,A%:REM MAKE BORDER
   GRAY
40 C=VAL(C$)
50 POKE C,$A0:REM POKE TO SCREEN
```

Function names can have periods and BASIC keywords included, but a keyword by itself will be interpreted as a command. For example, PRG.ENDING in line 30 below works correctly, but if you change it to PRG.END, you get a syntax error. To define or invoke a function, you do not need the FN prefix.

```
10 DEF PEEK.WORD(ADR)=PEEK(A)
   + PEEK(A+1)*256
20 PRG.START=PEEK.WORD(43)
30 PRG.ENDING=PEEK.WORD(45)
```

Notice the parentheses—arrays are addressed with square brackets.

Syntax errors are elaborated upon in BASIC 10's error messages. There are now three types of syntax errors:

```
?OPERAND MISSING OR INVALID
  ERROR
?EXPECTING this FOUND that ERROR
?SYNTAX ERROR
```

This familiar message still shows up when a delimiter (usually a colon) is missing.

Super Loops

One of the first lessons of structured programming is that GOTO statements are dangerous. Overuse of

GOTO can lead to spaghetti code—a program that, with all its loops and branches, can be difficult to follow. BASIC 10 includes two loop commands to replace most GOTOs. The REPEAT/UNTIL loop always executes at least once. It loops until the test condition is true. This example forces you to enter a name:

```
10 REPEAT
20 INPUT NAME$
30 UNTIL NAME$<>""
```

BASIC 10 also supports WHILE/WEND loops. The condition is checked before you enter the loop. The WHILE loop executes zero or more times.

```
10 PRINT "SPACE TO CONTINUE"
20 WHILE KEY$<>"" DO
30 GET KEY$
40 WEND
```

Better Flow

IF/THEN/ELSE and selective RESTORE are included for more control and flexibility. IF statements may include an ELSE clause as long as it appears in the same line. The IFs can also be nested. Here's a sample:

```
10 IF SCORE1>SCORE2 THEN
 PRINT "PLAYER 1"
 :ELSE IF SCORE1<SCORE2 THEN
 PRINT "PLAYER 2 WINS"
 :ELSE PRINT "A TIE"
```

RESTORE can be followed by a line number. Data is read from that line. If no line number is given, it acts like a normal RESTORE.

```
10 RESTORE 30:READ A:REM A=50
20 DATA 35
30 DATA 50
```

Reading Joysticks

Use the JOY command to read joystick direction, and use FIRE to read the fire button. Both commands need the port number. JOY returns a number between 0 and 10 corresponding to the chart below:

5	1	9
4	0	8
6	2	10

Fire returns −1, for *true*, if the button is pressed, and returns 0 otherwise. Here's a sample program that reads the joystick and fire-button status:

```
10 J=JOY(1):REM READ PORT 1
20 IF J=1 THEN PRINT "UP"
30 PRINT "PRESS PORT 2 FIRE"
40 WHILE FIRE(2)=0 DO
50 WEND
```

Strings and Screen

BASIC 10 has HOME to move the cursor to the upper left corner and CLS to clear the screen and home the cursor. The LOCATE command moves the cursor and uses the syntax

LOCATE *row, column*

The top left corner is 0,0 and the bottom right is 24,39.

```
10 CLS
20 LOCATE 12,17
30 ?"MIDDLE"
40 HOME
50 ?"TOP"
```

The syntax for STRING$ is

STRING$(*l,c*)

A string of length *l* is returned, consisting of characters equal to the ASCII value of *c*.

```
10 REM MAKE A BLANK STRING
'20 BLANK$=STRING$(39,32)
30 REM PRINT WITH LEADING
   ZEROES
40 N=96
50 PRINT STRING$(6-LEN(STR$(N)),48)
60 PRINT MID$(STR$(SCORE),2)
```

The syntax for INSTR is

INSTR(*src$,ss$*)

This returns the position of the substring (ss$) in the source string (src$). If the substring is not found in the source string, a 0 is returned.

```
10 NAME$="FRALEIGH,JOHN"
20 COMMA=INSTR(NAME$,",")
30 FIRST.NAME$=MID$(NAME
   $,COMMA +1)
40 LAST.NAME$=LEFT$(NAME
   $,COMMA-1)
```

See program listing on page 69. **G**

BASIC 10 Quick Reference

Installation

```
LOAD"BASIC 10"
RUN
POKE44,16:POKE4096,0:NEW
```

Details

Arrays use square brackets. Hexadecimal numbers are allowed. Include a space after all BASIC tokens (especially FOR).

Summary of New Commands

REPEAT
commands
UNTIL *condition*

loop always executes at least once, repeats until condition *is true*

WHILE *condition* **DO**
commands
WEND

loop continues as long as condition *is true*

IF *condition* **THEN** *command* **:ELSE** *command*

only one command allowed after THEN

RESTORE *line number*

makes subsequent READ commands get data starting at that line number

JOY(*port number*)

port number *is 1 or 2, returns a number corresponding to direction joystick is pressed*

FIRE(*port number*)

port number *is 1 or 2, returns −1 if button is pressed, 0 if not*

HOME

sends cursor to top left corner of screen

CLS

clears screen and homes cursor

LOCATE *row, column*

moves cursor to row and column indicated; row *ranges from 0 to 24, and* column *ranges from 0 to 39*

STRING$(*length, code*)

returns string of indicated length, consisting of character given by ASCII code

INSTR(*source string, substring*)

returns a number indicating where substring can be found in source string

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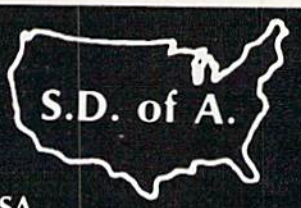

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SPRITE FADER *for the* 128

Peter M. L. Lottrup

Liven up your text display with this utility for the Commodore 128. A disk drive is required.

Few programs take advantage of the 128's special capabilities. One of these—and a major advantage over the 64—is designated areas for sprite and other graphics data. As a result, many BASIC 7.0 programs, although replete with graphics, require no memory reconfiguration. Indeed, it was this feature of the 128 that led to the development of "Sprite Fader."

Sprite Fader is a machine language utility that uses sprites to display a text string. It takes a given text string, converts it to a series of sprites, and then slowly fades it in at a specified location, a pixel at a time. Since your text is now in sprite form, you can easily create banner effects—scrolling messages across the screen—by using BASIC 7.0's built-in commands. With Sprite Fader at work, your programs will take on a professional look.

Typing It In

Sprite Fader (Program 1) is written entirely in machine language. To enter it, use the 128 version of "MLX," the machine language entry program found elsewhere in this issue. When MLX prompts you, respond with the values given below.

Starting address: 1300
Ending address: 15DF

Before you exit MLX, save a copy of the program to disk with the filename FADER.ML.

Program 2 is a demo that shows you how to use Sprite Fader from within your BASIC programs. To prevent typing errors, use "The Automatic Proofreader" when you enter this program.

Materializing a String

Using Sprite Fader is a two-step process. First, you must call a routine that designates where the text string will be located on the screen. Then, you call a second routine that identifies the string you wish to display. Both routines are called with the SYS command.

To position the text string, use a command of this format:

SYS 4864,*row,column,size*

Row and *column* represent the coordinates for the top left corner of the display. Sprite Fader uses the standard BASIC 7.0 sprite-coordinate system. With this system, the visible portion of the sprite screen includes locations 24–344 on the *x*-axis and 50–249 on the *y*-axis. But here, *row* and *column* are limited to the range 0–255.

The final parameter, *size*, is the expansion factor for the text (0–3). A value of 0 leaves text unchanged. A value of 1 makes the characters twice their normal height. A value of 2 makes them twice as wide. And a value of 3 doubles both their height and width.

In addition to the size of the text, you can also alter its color. Quite simply, the color displayed corresponds to the current text color. This must be set prior to executing the above SYS. Set the text color as you normally would: with PRINT (by simultaneously pressing CONTROL or Commodore and a number 1–8), with POKE (by storing the color value 0–15 into the register at 241), or with the COLOR statement (COLOR 5,*n*—where *n* is the color value 1–16).

The second call, which assigns the text string, is

SYS 4867,,,,,*string variable*

String variable is any text string that is between 1 and 24 characters in length. Values outside this range will cause an ILLEGAL QUANTITY error.

Note that you must pass the text string to the routine in the form of a string variable (like A$), not a literal string (like "HELLO"). Also, be sure you've included all five commas before *string variable*.

After you've executed this last SYS command, the routine creates the fade effect, building the text pixel by pixel. To fade text out, just overwrite it with new text. Or, you can define *string variable* as " " (a single space in quotation marks) and repeat the second SYS call. Both approaches are demonstrated in Program 2.

See program listings on page 68. **G**

Comparator

Michael J. Gibbons

Find the differences between two BASIC programs quickly and easily. For the Commodore 64 with disk drive.

If you've done much BASIC programming, you've undoubtedly run into a situation where you needed to know the differences between two versions of the same program. Maybe you needed to know what changes were made to a program or which version of a program was the most recent. Whatever the situation, a BASIC comparison utility is a useful addition to any programmer's collection. "Comparator" scans two BASIC programs and lists all lines that have been added, deleted, or changed. You can send its output to either the screen or the printer.

Getting Started

Since Comparator is written in machine language, you need to enter it using "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, you're asked for the starting and ending addresses of the data you're entering. The MLX prompts, and the values you should type in, are as follows:

Starting address: C000
Ending address: C3A7

Follow the MLX instructions carefully and be sure to save a copy of Comparator before you exit MLX.

Comparator compares two BASIC programs, one in memory, the other on disk. To use the program, first load Comparator. Then load one of the two programs to be compared. Next, place into the disk drive the disk containing the other program. Start the comparison by typing SYS 49152. Comparator first asks for the name of the program in memory, then asks for the name of the program on disk. Finally, it asks whether you want the listing to be printed to the screen or the printer. Enter either *S* (screen) or *P* (printer).

There are two possible types of differences between program files. One program may contain a line that the other does not, or both may contain a line with the same line number but different commands.

Comparator prints a simple report detailing the differences between the two programs. It prints the name of the program before each line that is different. When one program contains a line that the other does not, Comparator prints only that line. When both programs contain the same line number but the line is different, it prints both lines.

Armed with a Comparator listing, you'll be able to see the quantity and character of the differences between two programs.

Comparator and the 128

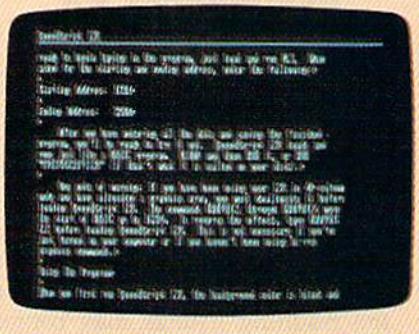
Comparator can also be used to compare 128 BASIC programs, but the resulting listings may contain some garbage. The garbage appears because the program trips over the keywords that are available in the 128's BASIC 7.0 but not in the 64's BASIC 2.0.

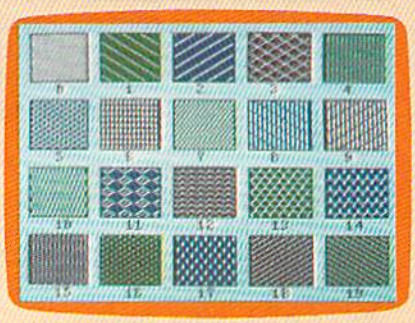
If you wish to compare 128 BASIC programs with Comparator, run it from 64 mode and follow the instructions for comparing 64 programs.

See program listing on page 67. **G**

BUILT FOR SPEED

Now Get Inside Your Commodore with *COMPUTE!'s Gazette Disk.*





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SUPER ACCELERATOR FOR THE 128

Increase the speed of your 128 by 20 percent with this amazing utility.

Philip Landman

With "Super Accelerator," you can speed up all operations of your Commodore 128 by as much as 20 percent. This short (135-byte) machine language routine is especially useful while you're using 40-column screens.

Super Accelerator works with any program, BASIC or ML, that doesn't use locations 4864–4999 and that leaves the interrupt at 788 intact. Unlike some accelerator programs, Super Accelerator doesn't interfere with the 128's built-in clocks.

Getting Started

Super Accelerator, Program 1, is a BASIC loader. To prevent typing mistakes, be sure to use "The Automatic Proofreader," found elsewhere in this issue, when entering the program.

Once you've finished typing, save a copy of the program and type RUN. Super Accelerator is POKEd into memory and activated.

Super Accelerator isn't disabled by RUN/STOP–RESTORE. If you wish to disable the program, type SYS 4978. To reenable the program, type SYS 4864. These SYS commands can be used from within your programs or in direct mode.

When Super Accelerator is activated, the FAST command doesn't work. Also, split-screen graphics mode cannot be used in conjunction with the program. You can use Super Accelerator while in 80-column mode, but since the 80-column mode isn't blanked by FAST mode, using the FAST command is a better alternative.

To test the speed increase obtained with Super Accelerator, type in Program 2, "Super Accelerator Demo." Program 2 records the times necessary to draw some circles on the screen with and without Super Accelerator activated; then it displays the times and the difference.

Super Accelerator works by putting the 128 in SLOW mode when it's drawing the screen and in FAST mode when it's doing anything else. Super Accelerator doesn't double or nearly double the computer's speed (as FAST mode does) because the 128 spends approximately 60 percent of its time updating the screen. It spends the other 40 percent processing other information. Super Accelerator reduces the time needed to execute this 40 percent by switching into FAST mode. Theoretically, then, a 20-percent increase in speed is achieved.

See program listings on page 70. **G**

Odometer

Buck Childress

Keep an eye on the valuable space left on each and every one of your disks. For the 64.

Save, load, and verify operations are notoriously slow on the 1541 disk drive. If you've ever wondered what your disk drive was up to during these interminable operations, you'll take "Odometer" to heart.

Odometer's job is to report to you whenever you make a save, load, or verify. When you save a program, Odometer first shows you the length (in disk blocks) of your program and the number of blocks free on your disk. As the operation progresses, you'll see the number of blocks left to be saved and the number of blocks remaining on the disk. When you load or verify a program, Odometer shows you the length of the file that you are loading or verifying. As the operation takes place, you're shown the number of blocks that have been loaded.

Typing It In

Odometer is written in machine language. Type it in with "MLX," the machine language entry program found elsewhere in this issue. When MLX prompts you for the starting and ending addresses, respond with the values given below.

Starting address: CB20
Ending address: CEC7

Carefully type in the data for Odometer. Be sure to save the program to disk before you exit MLX.

To use Odometer, load the program with a statement of the form LOAD"ODOMETER",8,1. Type NEW. Now type SYS 52000 to activate the program. Every save, load, and verify will be monitored by Odometer. Odometer works on a 64 (or a 128 in 64 mode) with either the 1541 or 1571 drive. To deactivate the program, simply type the same command you used to activate it—SYS 52000.

Odometer disables fast loaders and other devices that need the vectors Odometer uses. When you deactivate the program, the vectors are restored.

Once in a while, Odometer may say that one more block was saved, loaded, or verified than the directory shows. That's because of a quirk in Commodore's DOS. If the disk operation ends and the DOS pointers are pushed into the next track, the program takes up one more block than is shown. Don't worry about the difference—it's inconsequential.

Odometer also has a drive-status checker. If the drive light blinks, press the at key (@) and then press RETURN. The drive's status is displayed.

See program listing on page 67. **G**

feedback

Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, **COMPUTE!'s Gazette,** *P.O. Box 5406, Greensboro, North Carolina 27403. We regret that, due to the volume of mail received, we cannot respond individually to programming questions.*

Golf Handicapper

I've written a short BASIC program for the 64 that calculates golf handicaps and would like to share it with your readers.

Robert McGowan
Goleta, CA

Thanks for sending us this program. It so happens that recently we've had a number of requests for a golf-handicap calculator. Apparently, with spring upon us, many readers are back on the links.

We've listed the program with checksums so it can be typed in with "The Automatic Proofreader."

```
PJ 10 DIM S(20),L(12):CR=68:PR
      INT"{CLR}GOLF HANDICAP C
      ALCULATOR"
MJ 20 INPUT"{DOWN}ENTER PLAYER
      'S NAME";PN$:IF PN$="" T
      HEN PRINT"{2 UP}";:GOTO2
      0
QH 30 F$=LEFT$(PN$,12)+".DAT"
HK 40 OPEN 2,8,2,F$:OPEN15,8,1
      5:INPUT#15,A$,B$:CLOSE15
MG 50 IF A$="62" THEN CLOSE2:G
      OSUB340:GOTO100
MG 60 CLOSE2:OPEN 2,8,2,F$:VM=
      20.1
EQ 70 FOR I=1 TO 20:INPUT#2,S(
      I):IF S(I)<0 THEN VM=I:I
      =20
CD 80 NEXT I:CLOSE2:IF VM=20.1
       THEN VM=20:FOR I=0 TO 1
      9:S(I)=S(I+1):NEXT
MJ 90 INPUT"{DOWN}ENTER NEW SC
      ORE";S(VM):IF VM<20 THEN
       S(VM+1)=-1
GK 100 Q=1:L(1)=S(1):QM=11:IF
       {SPACE}VM<QM THEN QM=VM
RH 110 FOR I=2 TO VM
MF 120 FOR J=1 TO Q
GS 130 IF S(I)<L(J) THEN FOR K
       =Q TO J STEP-1:L(K+1)=L
       (K):NEXT:L(J)=S(I):J=Q+
       10
FJ 140 NEXT J:Q=Q+1:IF Q>QM TH
       EN Q=QM
MG 150 IF J<=Q THEN L(Q)=S(I)
KA 160 NEXT I
RS 170 IF VM=20 THEN PRINT"
       {DOWN}THE LAST TWENTY S
       CORES:":GOTO190
AK 180 PRINT"{DOWN}"VM"SCORES:
       "
DB 190 FORI=1 TO VM:PRINTS(I);
       "{LEFT}";:IF I=10 THEN
       {SPACE}PRINT
BM 200 NEXT:PRINT
JR 210 T=0:PRINT"{DOWN}LOW SCO
       RES USED IN COMPUTATION
       :"
HG 220 IF VM<5 THEN PRINT"5 OR
        MORE SCORES NEEDED FOR
        HANDICAP.":GOTO280
JR 230 IF VM<17 THEN M%=1+(VM-
       5)/2
CP 240 IF VM>16 THEN M%=VM-10
DR 250 FOR I=1 TO M%:PRINT L(I
       )"{LEFT}";:T=T+L(I)-CR:
       NEXT:T=T/M%*10:H=INT(T*
       .096+.5)
PA 260 PRINT:PRINT"{DOWN}HANDI
       CAP:";:IFH<0THENPRINT"
       {SPACE}+";
XR 270 PRINTABS(H)
AC 280 PRINT"{DOWN}SAVE TO DIS
       K (Y/N)?":GOSUB460
RK 290 IF R=0 THEN330
AC 300 OPEN 15,8,15:PRINT#15,"
       S0:";F$:CLOSE15
FK 310 OPEN 2,8,1,F$
AS 320 FOR I=1 TO VM:PRINT#2,S
       (I):NEXT:PRINT#2,-1:CLO
       SE2
DM 330 END
EF 340 PRINT"{DOWN}{RVS}A NEW
       {SPACE}PLAYER"
XF 350 PRINT"ENTER "PN$"'S LAS
       T TWENTY SCORES"
SC 360 PRINT"{DOWN}IF YOU DON'
       T HAVE 20, ENTER -1 AFT
       ER{4 SPACES}LAST SCORE"
KB 370 FOR V=1 TO 20:INPUT S(V
       )
MB 380 VM=V:IF S(V)=-1 THEN VM
       =V-1:V=20
BM 390 NEXT
ES 400 PRINT"{CLR}"PN$"'S LAST
       "VM"SCORES:"
AJ 410 FOR I=1 TO VM:PRINT "#"
       I"{2 SPACES}SCORE"S(I):
       NEXT
EB 420 PRINT"ARE THESE SCORES
       {SPACE}OKAY (Y/N)?":GOS
       UB460
XJ 430 IF R THEN RETURN
DE 440 INPUT"ENTER # OF BAD SC
       ORE";N:IF N<1 OR N>VM T
       HEN PRINT"{UP}";:GOTO44
       0
DG 450 PRINT"CORRECT #";N;:INP
       UT S(N):GOTO400
SA 460 GETA$:IF A$="Y" THEN R=
       1:RETURN
HX 470 IF A$="N" THEN R=0:RETU
       RN
RE 480 GOTO460
```

This program computes a golfer's handicap by a method of differentials. First, it takes the lowest ten scores of the player's last 20 rounds and determines the difference between each score and the course rating (its par value) as defined in line 10 by variable CR. Then, it totals these ten differentials, averages them, and converts the result to a handicap based on 96 percent of the average.

To use the program, you'll need to supply it with at least 5 golf scores. The first time you run it, enter your most recent 20 scores. If you don't have 20, enter the ones you have, and enter −1 as your final score.

With fewer than 20 scores, the program calculates the handicap differently. For example, if you enter 5 or 6 scores, the program uses only the differential from the lowest score. Enter 7 or 8 scores, and differentials from the lowest 2 scores are used; enter 9 or 10 scores, and the lowest 3 are used; and so on. This pattern continues until there are 17 or more scores. At this point, the program subtracts 10 from the number of scores and uses this as the basis for the handicap calculation. (So, with 17 scores, differentials from the lowest 7 are used.)

The program maintains a separate data file on disk for each golfer's scores. You can easily spot these files in the directory; the first 12 characters of a player's name are used along with the extension .DAT. Because of this, it's important that you always use the same name when referring to a particular player.

When you run the program, it reads in a player's data file and updates it with the latest golf score. If

two rounds of golf have been played since the last update, run the program twice to enter each score. Once the number of scores exceeds 20, the program discards the first score in a player's file.

If you play on different courses, you may need to change the course rating, in line 10. Since the program has no provision for keeping track of scores from courses with different ratings, you may want to use a separate program disk for each course.

Some Clarifications

I just noticed an item in "Simple Answers to Common Questions" in the August 1988 issue of *Gazette* which needs clarification.

The outer plastic case on the 1541 disk drive has *nothing* to do with the radio frequency (RF) shielding. The shielding is accomplished by the perforated metal cover over the circuit board and by the metal chassis.

The outer cover *does* serve a definite purpose, though. It keeps prying fingers, dust, dirt, and other potentially harmful objects out of the works! If you are sure that no foreign objects will get into the 1541, leaving the top off is an effective way to keep the drive cooler.

A second item that needs attention concerns a remark I've seen in several computer magazines which goes something like this: "Before you touch a MOS or CMOS integrated circuit (IC or *chip*), you should touch a metal object to discharge any static on the body." This advice is worthless unless the metal object you touch is securely grounded. Touching a metal object that's not grounded may actually cause you to pick up a static charge. The safest practice is to use a grounded wrist strap. A good low-cost wrist strap for occasional use is available from Radio Shack.

Robert J. Nedreski
Erie, PA

You're right on both points. Thanks for the helpful comments.

An Alarming Situation

I'm trying to write an alarm clock program in BASIC on the 64. My problem is that while the program is running, I can't do anything else without stopping the clock. Can you show me a way to put this program in memory so I can continue programming while waiting for the alarm to go off?

David Crow
McAlester, OK

The best approach to this task is to "wedge" an alarm-clock routine into the 64's normal interrupt handler. By programming this routine in machine language (ML), you'll get the alarm clock to run in the background, leaving the current BASIC program undisturbed.

Fortunately for us, the 64 is equipped with a built-in alarm function that we can utilize in our program. In fact, there are two such alarms—one for each time-of-day (TOD) clock. To use one of these, we must set the clock and the alarm time, just as you would on any alarm clock. When the clock time matches the alarm time, the TOD clock triggers an interrupt.

In this case, we'll use the second TOD clock, which causes an NMI interrupt when the alarm goes off. To set up the routine, we point the normal NMI interrupt vector to our alarm routine, set the clock and alarm times, and then wait for an NMI interrupt to occur.

NMI interrupts can originate from two sources on the 64—from the RESTORE key or from the second CIA chip. If CIA #2 causes the interrupt, we examine a bit in the interrupt control register at location 56589 to determine whether the TOD alarm caused the interrupt. If so, we produce a tone sound using the SID chip.

Below is a BASIC loader that POKEs the machine language for our alarm-clock routine into memory. The ML for this routine was taken from COMPUTE! Books' Machine Language Routines for the Commodore 64 and 128. *You can find the source code for this routine under the entry ALARM2.*

```
KG 10 REM DIGITAL ALARM CLOCK
FR 20 FORI=49152TO49283:READA:
      X=X+A:POKEI,A:NEXTI:REM
      {SPACE}POKE ALARM ML ROU
      TINE
CJ 30 IFX<>15756THENPRINT"DATA
       STATEMENT ERROR.":STOP
BG 40 A$="CLOCK":C=49288:GOSUB
      280:A$="ALARM":C=49284:G
      OSUB280:REM GET TIMES
GX 50 SYS49152:END:REM SET ALA
      RM
BM 60 DATA 169,42,141,24,3,169
GB 70 DATA 192,141,25,3,173,15
BF 80 DATA 221,9,128,141,15,22
      1
EB 90 DATA 160,0,32,102,192,17
      3
CQ 100 DATA 15,221,41,127,141,
      15
RQ 110 DATA 221,160,4,32,102,1
      92
XK 120 DATA 169,132,141,13,221
      ,96
BG 130 DATA 173,13,221,41,4,24
      0
RD 140 DATA 50,169,4,141,13,22
      1
RJ 150 DATA 32,115,192,169,13,
      141
CX 160 DATA 24,212,169,0,141,5
HA 170 DATA 212,169,240,141,6,
      212
ED 180 DATA 169,4,141,1,212,16
      9
CA 190 DATA 33,141,4,212,32,15
      9
FX 200 DATA 255,165,198,240,24
      9,32
KS 210 DATA 115,192,32,126,192
      ,169
HD 220 DATA 0,133,198,76,71,25
      4
SJ 230 DATA 162,3,185,132,192,
      157
DH 240 DATA 8,221,200,202,16,2
      46
AS 250 DATA 96,169,0,160,24,15
      3
DP 260 DATA 0,212,136,16,250,9
      6
RS 270 DATA 120,32,138,255,88,
      96
PH 280 PRINT"{CLR}FOR THE "A$"
       TIME:"
EG 290 PRINT:INPUT"WHAT IS THE
       HOUR";H$:H=VAL(H$):IFH
      <0ORH>12THEN290
RJ 300 F=0:INPUT"AM OR PM";F$:
      IFLEFT$(F$,1)="P"THENF=
      128
EB 310 HN=0:IFH>9THENHN=16
SB 320 HH=VAL(RIGHT$(H$,1)):H=
      F+HN+HH:POKEC+0,H
AE 330 INPUT"WHAT IS THE MINUT
      E";M$:M=VAL(M$):IFM<0OR
      M>59THEN330
BK 340 MN=0:IFM>9THENMN=16*VAL
      (LEFT$(M$,1))
HX 350 MM=VAL(RIGHT$(M$,1)):M=
      MN+MM:POKEC+1,M
FA 360 INPUT"WHAT IS THE SECON
      D";S$:S=VAL(S$):IFS<0OR
      S>59THEN360
MG 370 SN=0:IFS>9THENSN=16*VAL
      (LEFT$(S$,1))
KR 380 SS=VAL(RIGHT$(S$,1)):S=
      SN+SS:POKEC+2,S:POKEC+3
      ,0:REM SECS, TENTHS OF
      {SPACE}SECS
PX 390 RETURN
```

To activate the alarm-clock routine, enter the program and type RUN. After the machine language has been POKEd into memory, the program prompts you for the clock and alarm times. Once you've entered these, the clock starts and the alarm routine activates. As long as you leave the NMI vector at location 792 intact, you can go about programming as you normally would. When the alarm sounds, just press any key to turn off the tone.

64 Screen Saver

Can you provide me with a program to save the screen to disk on the Commodore 64?

Ron Jentz
West Seneca, NY

In saving text screens to disk, you'll want to save color memory (locations 55296–56319) along with text (locations 1024–2023). The following BASIC loader places a machine language (ML) program at location 828 that saves text and color memory as separate disk files:

```
DA 10 FORI=828TO988:READA:POKE
      I,A:X=X+A:NEXT:IFX<>2132
      0THENPRINT"DATA ERROR.":
      STOP
KB 20 SYS828
MX 30 DATA 120,169,78,141,20,3
      ,169,3,141,21
RR 40 DATA 3,169,0,141,219,3,8
      8,96,173,219
DS 50 DATA 3,240,3,76,49,234,1
      65,203,201,4
FF 60 DATA 208,124,173,141,2,2
      01,2,208,117,141
XQ 70 DATA 219,3,165,157,141,2
      20,3,169,0,133
HA 80 DATA 157,162,1,134,205,1
      66,207,208,252,169
KR 90 DATA 1,133,204,173,0,221
      ,73,3,133,252
XP 100 DATA 173,24,208,41,240,
       102,252,106,102,252
BJ 110 DATA 106,133,252,169,0,
       133,251,169,1,162
KQ 120 DATA 8,160,0,32,186,255
       ,173,167,2,162
GS 130 DATA 168,160,2,32,189,2
       55,162,232,24,165
CA 140 DATA 252,105,3,168,169,
       251,32,216,255,162
KM 150 DATA 0,134,251,160,216,
       132,252,173,184,2
GB 160 DATA 162,185,160,2,32,1
       89,255,169,251,162
QS 170 DATA 232,160,219,32,216
       ,255,169,0,141,219
EF 180 DATA 3,173,220,3,133,15
       7,76,49,234,0,0
```

To install the screen saver in memory, just type RUN.

Before you save a screen, you need to specify names for the two files that will contain text and color memory. The ML routine above looks for these filenames, along with their lengths, beginning at locations 679 and 696, respectively. To position the chosen filenames into memory, use the two-liner below:

```
10 T$="TEXT":S=679:GOSUB20:T$=
     "COLOR":S=696:GOSUB20:EN
     D
20 L=LEN(T$):POKES,L:FORI=1TOL
     :POKES+I,ASC(MID$(T$,I,1
     )):NEXT:RETURN
```

If you'd prefer filenames other than TEXT and COLOR, substitute them into line 10 before you run this program.

Next, create your text screen. Use any keys you wish. To change the character colors, use the CTRL or Commodore keys in combination with the number keys 1–8.

When you've completed your screen and are ready to save it, simply hold down the Commodore key and press f1. The routine at 828, called during each IRQ interrupt, checks for this particular sequence of keypresses. If the sequence is found, the routine locates the text screen in memory and saves it along with color memory by the filenames you've assigned. If you wish to save the text screen more than once to the same disk, be sure to rerun the above two-liner using two new filenames. Otherwise, you'll get a disk error as you attempt to overwrite the previously saved files.

To reload a screen file without disturbing the resulting display, run the following short program. Again, be sure to specify the filenames that represent your text and color-memory files.

```
10 IFA=0THENA=1:POKE53265,PEEK
     (53265)AND239:REM BLANK
     {SPACE}SCREEN
20 IFA=1THENA=2:LOAD"TEXT",8,1
30 IFA=2THENA=3:LOAD"COLOR",8,
     1
40 POKE53265,PEEK(53265)OR16:R
     EM TURN ON SCREEN
50 GOTO50
60 REM CONTINUE BASIC PROGRAM
```

Commodore disk loads are typically sluggish. This is no more apparent than when you're loading screens. So here, rather than forcing the user to watch the screen slowly piece together, we blank the video display prior to the load (line 10). Afterward, we turn the screen back on (line 40) and put the program in an endless loop (line 50). This prevents the custom screen from scrolling or being altered by BASIC's READY prompt.

You may be wondering if there's a practical use for this last routine. One comes to mind: If you place the routine at the beginning of a program, you can load and display a custom title screen that you've previously created. This can be done with very little effort. Just replace line 50 with a delay loop (for example, 50 FOR I=1 TO 3000:NEXT I), and continue your program from there. **G**

ADVERTISEMENT

Flight notes

6A

Exploring Stealth Mission

Several man-years went into developing Stealth Mission for the Commodore 64/128 computers. The program incorporates many new design concepts. Target-hit detection, for example, is embedded within the Stealth Mission scenery structure itself. This lets the software designer easily assign a different score value to each potential target, including negative scores for destroying targets that should be avoided (hospitals, for example). Programmable scoring is just one unique feature of this third-generation flight simulator.

Stealth Mission Reviews

While we don't like to brag, we certainly can't argue with Stealth Mission reviews like these. Ahoy magazine (7/88) writes that this simulator "pushes the C64/128 envelope beyond the blue horizon, to a whole new level of animation and frame rates... absolutely incredible." Stealth Mission "... sets new standards at the top of the C64 flight simulator heap," according to Info (5-6/88). Commodore (2/89) calls Stealth Mission's combination of strategy and action "truly superior to others. Only a flight simulation this good could come from SubLOGIC." Stealth Mission, winner of the 1988 Consumer Electronics Show "Best Strategy Game" Software Showcase Award. What more can we say?

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bug-swatter

● The final version of line 130 under the heading "Reformatting Disks" in the December 1988 "Feedback" column has a minor problem that may cause a disk drive error. Line 130 sends the disk name and disk ID together as if they were one string. For example, if C$="BLANK" and D$="89", the disk drive receives N0:BLANK89. If you're trying to format a disk that has been formatted before, this line works without causing an error but doesn't reformat the disk. It erases the disk and gives it the name BLANK89; the disk ID doesn't change. If the disk you're trying to format has never been formatted, this line causes an error.

To correct this problem, change line 130 as follows:

```
130 PRINT#15,"N0:"C$","D$
```

If the example above is used with the new line 130, the disk drive receives N0:BLANK,89. Now, the disk will always be formatted correctly.

● In the August 1988 "Bug-Swatter," we published a correction for "Speed File for the 64" (April 1988). This correction fixed two bugs—one in the print routine and one causing some characters to be invisible on older 64s. Originally, we had a separate correction for each of these problems. In that column, we combined the two corrections into one. The problem is that the two solutions don't work together.

To get Speed File to print correctly, load the program with a line like **LOAD"*filename*",8**. Then enter the following commands in direct mode:

```
POKE7669,169:POKE7670,0:POKE7671,
  168:POKE7672,32
POKE7673,189:POKE7674,255:POKE7675,
  169:POKE7676,4
```

Once you've entered the POKEs, save Speed File to a new file with a new name. Use a command similar to **SAVE"*filename*",8**. This new version of Speed File prints correctly.

To get Speed File to display characters correctly on older 64s, use the following patch program:

```
SP 10 T=828:X=0
CD 20 READ A:IF A<0 THEN40
QB 30 X=X+A:POKE T,A:T=T+1:GOT
      O20
KD 40 IF X<>19631 THENPRINT"ER
      ROR IN DATA":STOP
KS 50 F$="SPEEDFILE":REM IF YO
      U USED A DIFFERENT NAME,
       SUBSTITUTE IT HERE
HG 60 T=LEN(F$):POKE 972,T
HA 70 FOR I=1 TO T
DM 80 POKE 972+I,ASC(MID$(F$,I
      ,1))
SR 90 NEXT:SYS828
EB 100 DATA169,1,162,8,160
DC 110 DATA0,32,186,255,173
SX 120 DATA204,3,162,205,160
ER 130 DATA3,32,189,255,169
QE 140 DATA0,166,43,164,44
SP 150 DATA32,213,255,134,45
DR 160 DATA132,46,32,51,165
GE 170 DATA169,8,133,252,169
QA 180 DATA1,133,251,169,0
JQ 190 DATA133,253,170,168,177
JE 200 DATA251,221,201,3,240
GM 210 DATA19,200,208,246,165
RH 220 DATA252,24,105,1,133
BH 230 DATA252,133,254,201,35
PQ 240 DATA208,233,76,13,8
EE 250 DATA232,224,3,208,232
CB 260 DATA162,0,169,153,145
DB 270 DATA253,169,3,145,251
KA 280 DATA76,116,3,201,147
MS 290 DATA240,6,201,19,240
BR 300 DATA2,208,35,141,204
SH 310 DATA3,152,72,173,204
GX 320 DATA3,32,210,255,169
GX 330 DATA0,168,153,0,216
FF 340 DATA153,0,217,153,0
FC 350 DATA218,153,232,218,136
DR 360 DATA208,241,104,168,173
PH 370 DATA204,3,96,76,210
QF 380 DATA255,32,210,255,-1
```

To use the patch program, simply load it and type RUN. It loads Speed File, makes the corrections, and runs the program. Each time you use Speed File, load and run the patch program, and Speed File will automatically load and run correctly.

If you entered the correction from the August 1988 column, simply change lines 90 and 100 in the correction from that issue as follows:

```
90 NEXT
100 SYS828
```

G

USER GROUP Update

Mickey McLean

The following list includes updated entries to our annual "Guide to Commodore User Groups," which last appeared in the May and June 1988 issues.

Send typed additions, corrections, and deletions for this list to

Commodore 64/128 User Group Update
COMPUTE!'s Gazette
P.O. Box 5406
Greensboro, NC 27403

When writing to a user group for information, please remember to enclose a self-addressed envelope with postage that is appropriate for the country to which you're writing.

User Group Notes

The **Greater Omaha Commodore Users Group** (P.O. Box 241155, Omaha, Nebraska 68124) has added a bulletin board service. The phone number is (402) 455-6400.

The listing for the **Sanlee Commodore Club** in the January issue contained an incorrect zip code. The correct address is 514 Colonial Drive, Sanford, North Carolina 27505.

The **Central Texas Computer Users Group** has a new address. All correspondence should be sent to 902 Carlisle, Killeen, Texas 76541-7321.

The **Wisconsin Association of Vic/C= Enthusiasts (WAVE)** has also moved. Its new address is 1020 Kurtis Drive, Elm Grove, Wisconsin 53122.

New Listings

FLORIDA

Gulfcoast 64's Commodore Users Group, P.O. Box 11180, Clearwater, FL 34616

GEORGIA

Commodore Format User's Group, P.O. Box 91541, East Point, GA 30364

MASSACHUSETTS

Fall River Commodore's Club, 117 Lewin St., Fall River, MA 02720

OHIO

The Dayton Area Commodore Users Group (DACUG), 1117 Lavern Ave., Kettering, OH 45429

PENNSYLVANIA

Harrisburg Area Computer Group, 721 S. 29th St., Harrisburg, PA 17111

TENNESSEE

Dungeons and Dragons User Group, Rt. 1, Box 28A, Cumberland City, TN 37050

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THE programmer's page

April Fools

Randy Thompson

Feeling devious?

In the spirit of this issue's cover date, I've prepared a collection of programs that are best described as practical jokes. If you have the opportunity, run one of these mischievous hacks on your friend's or coworker's computer; then walk away and act innocent. These are also great programs to run at home, at school, or at a user group meeting before someone sits down to use the computer.

Most of these programs were thoroughly tested on unsuspecting technical editors here at COMPUTE!, so I can safely say that they work. Don't worry: These practical joke programs can't harm your computer—just your reputation.

Noise Bomb

"Noise Bomb" is a 64 program that pretends it isn't running when it actually is. To the uninformed, the computer looks as if you have just turned it on.

To give Noise Bomb a try, type in and save the following code. Turn up the volume on your monitor as high as you can without creating any distracting humming noises, and then load and run the program. Now, wait until someone tries to use the computer. The moment a key is hit . . . BRAAAAHP! . . . the noise bomb drops.

```
10 POKE 792,193:POKE 808,239:P
   OKE 780,115:POKE 782,228:SY
   S 43806
20 PRINT "38911 BASIC BYTES FR
   EE":PRINT:PRINT "READY."
30 POKE 204,0
40 GET K$:IF K$="" THEN40
50 POKE 54296,15:POKE 54296,0:
   GOTO 50
```

To stop Noise Bomb, you must turn off the computer or use a reset button. Hitting keys such as RUN/STOP–RESTORE only changes the pitch of the sound. (This is not what you'd call a user-friendly program.)

Cursor-Key Swap

When is up down and left right? When you run the following program on the 64:

```
10 FOR I=40960 TO 49151:POKE I
   ,PEEK(I):X=I+16384:POKE X,P
   EEK(X):NEXT
20 POKE 60291,157:POKE 60296,1
   45:POKE 60356,29:POKE 60361
   ,17
30 POKE 1,PEEK(1) AND 253
```

By copying BASIC ROM to RAM and then modifying the 64's keyboard lookup table, this short program makes the cursor-down key move the cursor up, the cursor-up key move the cursor down, the cursor-left key move the cursor right, and the cursor-right key move the cursor left—overall, a confusing situation.

Topsy-Turvy

This little program makes the 64's characters appear upside down. It takes a while to run, so be patient.

```
10 POKE 56334,0:POKE 1,51
20 FOR I=0 TO 2048:J=I-(I AND
   {SPACE}7)*2:POKE 12295+J,PE
   EK(53248+I):NEXT I
30 POKE 1,55:POKE 56334,1:POKE
    53272,29
```

Note that you can't just stand on your head to read what's on the screen. Because letters are still entered left to right, you must view the monitor upside down and with a mirror.

1571 Upgrade

Oops. The program designed to detect whether your 1571 has old ROMs ("Programmer's Page," February 1989) does *not* work. This short routine checks the drive's DOS version number, but this number is the same for all 1571 ROMs, old and new. Only the 128D's internal disk drive returns an updated DOS number of 3.1.

To find the official method of detecting whether your 1571 requires a ROM upgrade, I called Commodore's technical support line. Unfortunately, the technical support staff refused to give me any information that I might print. Strange policy, no? I suppose they prefer that you call them yourself. Anyway, the number to call is (215) 436-4200.

On a reader's recommendation, I called Century Computer in La Habra, California. Its technical staff was able to supply me with the information I required. According to them, there are *five* versions of ROM for the 1571, and the only true way to see which ROM your 1571 uses is to open it up and look at the number listed on the chip itself. It's best to have an authorized technician open your drive, since doing so yourself voids your warranty.

If you're determined to open the drive yourself, you'll find the ROM chip hidden under the disk drive's power supply. This chip is near the back of the unit and contains the number 310654. If you have the most up-to-date ROM, this number is followed by -05 (earlier versions are numbered 01–04).

Terminally Odd

Manny Israel of Murreta, California, found a mistake in the "Odd or Even?" tip published in the January 1989 "Programmer's Page." This tip describes an easy way to test whether a number is odd or even. The problem is not in the technique, but in the example program, which refuses to identify any number as even. The corrected program line reads:

```
10 IF (X AND 1)=0 THEN PRINT X
   ;"IS AN EVEN NUMBER."
```

The original program lacked parentheses. Without parentheses, the comparison IF 1=0 is tested before the AND operator kicks in, so PRINT X;"IS AN EVEN NUMBER" is never executed because 1 *never* equals 0—not even in April. **G**

BASIC for beginners

The Evolving Program

Larry Cotton

Last month, in order to further enhance our understanding of BASIC, we began writing a metric conversion program. This month, we'll finish this converter. (If you were able to complete the program on your own, compare your version to the one presented here.)

Since last month, our program has undergone several changes. These changes have been made primarily for two reasons: to show how a program evolves, and to make the program easier to understand.

The Menu

Now let's look at the program. The first few lines are the same:

```
10 PRINTCHR$(5):REM WHITE
   CHARACTERS
20 POKE53281,0:REM BLACK SCREEN
   (USE POKE65301,0 ON THE PLUS/4
   OR COMMODORE 16)
30 X=16:DIMC(X),I$(X),M$(X)
40 FORN=1TOX:READC(N),I$(N),M$(N):
   NEXT
50 PRINTCHR$(147):REM CLEAR
   SCREEN
```

We decided the program would convert English measurements to metric and vice versa. This requires that we double the number of options and, consequently, our menu size. One way to do this is to split the menu into two columns so it fits nicely onto one screen.

But what if you didn't have enough space on a single screen for this enhanced menu? First, you could offer the user a simple menu with two options: English to metric, and metric to English. Then, depending on the choice, you'd display only the appropriate conversions on a second menu screen.

Fortunately for us, all the options fit on one screen. And lines 60–210 become

```
60 PRINT"(1) IN TO KM (17) KM TO IN
70 PRINT"(2) IN TO M (18) M TO IN
80 PRINT"(3) IN TO CM (19) CM TO IN
90 PRINT"(4) IN TO MM (20) MM TO
   IN
100 PRINT"(5) FT TO KM (21) KM TO
   FT
110 PRINT"(6) FT TO M (22) M TO FT
120 PRINT"(7) FT TO CM (23) CM TO
   FT
130 PRINT"(8) FT TO MM (24) MM TO
   FT
140 PRINT"(9) YD TO KM (25) KM TO
   YD
150 PRINT"(10) YD TO M (26) M TO YD
160 PRINT"(11) YD TO CM (27) CM TO
   YD
170 PRINT"(12) YD TO MM (28) MM TO
   YD
180 PRINT"(13) MI TO KM (29) KM TO
   MI
190 PRINT"(14) MI TO M (30) M TO MI
200 PRINT"(15) MI TO CM (31) CM TO
   MI
210 PRINT"(16) MI TO MM (32) MM TO
   MI
```

while line 220 remains unchanged:

```
220 INPUT"[DOWN]WHICH NUMBER";
   N
```

Remember: N is the menu-option number. It will be used later as an index to our arrays. As I mentioned, we need to accommodate twice as many options. So, line 230 becomes

```
230 IFN<1ORN>32THEN50
```

Line 240 has evolved into its fourth incarnation since we started writing the program. It now sends program control to line 280, which handles menu options 17–32, the metric-to-English conversions. Since these are somewhat more complicated, we'll tackle them later.

```
240 IFN>16THEN280
```

English to Metric

Line 250 begins the English-to-metric conversions, which are simpler to understand:

```
250 PRINT:PRINT"QUANTITY OF "
   I$(N);
```

Let's say the user wants to convert 7 inches to centimeters. He or she has chosen menu-option number 3 in line 220, so N is 3. Since N is not greater than 16, control passes to line 250. Line 250 prints a blank line and the words QUANTITY OF, followed by a space.

Recall that line 40 reads in two sets of string arrays: I$(1)–I$(16), or the abbreviations for English system units, and M$(1)–M$(16), representing metric system units. We now use the number N to index these arrays.

After QUANTITY OF has printed, the computer looks up I$(3), finds IN (for inches), and prints it. Note carefully the semicolon just after I$(N). Next, line 260 accepts the user's input and calculates the answer:

```
260 INPUTQ:A=Q*C(N)
```

Because of the semicolon, the prompt (including INPUT's question mark) prints neatly on a single line like this:

```
QUANTITY OF IN?
```

Q is always the number of units to convert, whether they're English or metric. In our example, Q is 7 and N is 3. When we read the data in line 40, the first item in each group is a multiplication constant for converting English units to metric. In this case, C(3) is 2.54. When C(3) is multiplied by Q, or 7, the answer (A) is 17.78.

The next line prints this answer:

```
270 PRINT:PRINTQ;I$(N)" ="A;
   M$(N):END
```

First a blank line prints, then the value of Q. If a semicolon weren't used here, the computer would attempt to look up the value of QI$( ), which doesn't exist. Be very careful with semicolon placement.

The last parts of the PRINT statement are an equal sign followed by the answer A and M$(3), or "CM." Thus, the printed answer line becomes

```
7 IN = 17.78 CM
```

Metric to English

That's the easy part! The conversion from metric to English is a little

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tougher. The last three program lines, which parallel lines 250–270, handle this:

```
280 PRINT:PRINT"QUANTITY OF "
    M$(N-X);
290 INPUTQ:A=Q*1/(C(N-X))
300 PRINT:PRINTQ;M$(N-X)" ="A;
    I$(N-X):END
```

In these lines, we calculate the index to our arrays. This is a very important, useful concept in BASIC programming. Arrays are often accessed indirectly—that is, from calculations rather than from exact numbers.

Again recall that in line 40, we read in 16 groups of data. The first item in each group is a constant, C( ). Thus, C(1) is .0000254 and C(16) is 160934.4. (See the DATA statements below.) For the first 16 English-to-metric conversions, these constants are used as is. But for metric-to-English conversions (N = a number in the range 17–32), we need their *inverses.*

An inverse of a number is the number divided into 1. The inverse of 2 is 1/2 or .5; the inverse of 2.54 is about .3937. By using inverses, we can neatly generate the other 16 constants we need to handle the metric-to-English conversions.

Thus, when N is 1 or 17, C(1) is the conversion constant. The same relationship exists for the remaining constants. (When N is 2 or 18, the conversion constant is C(2), and so on.) To determine the appropriate conversion factor, all we need to do is subtract 16 from N whenever N exceeds 16.

In line 30, we defined the variable X as 16. Lines 280–300 subtract X, or 16, from N to index the arrays.

Now, let's consider an example. Suppose the user wants to convert 10 centimeters to inches. N will be equal to 19 from line 220. In this case, line 240 sends the program ahead to line 280. Here's what occurs in line 280:

1. The cursor moves down one line.
2. QUANTITY OF prints.
3. X is subtracted from N to give 3.
4. The value of M$(3), or CM, prints.

Line 290 waits for the user to input Q. At this point, the computer screen reads

```
QUANTITY OF CM?
```

The user enters 10. The computer performs the following:

1. Calculates N−X again to give 3.
2. Finds the value of C(N−X) to be 2.54.
3. Divides 1 by 2.54 to get approximately .3937.
4. Multiplies 10 (the value of Q) by .3937 to yield 3.937.

Thus, the value of A is 3.937. Line 300

1. Prints a blank line.
2. Prints Q as 10.
3. Calculates N−X again.
4. Prints CM again.
5. Prints an equal sign.
6. Prints the value of A as 3.937.
7. Calculates N−X again.
8. Prints the value of I$(3), or IN.
9. Ends the program.

The computer screen now reads

```
10 CM = 3.937 IN
```

To finish up, let's renumber our DATA statements in sequence:

```
310 DATA.0000254,IN,KM,.0254,IN,M,
    2.54,IN,CM,25.4,IN,MM
320 DATA.0003048,FT,KM,.03048,FT,M,
    30.48,FT,CM,304.8,FT,MM
330 DATA.0009144,YD,KM,.9144,YD,M,
    91.44,YD,CM,914.4,YD,MM
340 DATA1.609344,MI,KM,160.9344,MI,M,
    16093.44,MI,CM,160934.4,MI,MM
```

Testing

Now, try a few conversions. An easy way to test your program is to convert from one unit to the other and back again with the same measurement.

For instance, run the program and pick option 4 to convert inches to millimeters. At the prompt, type in 1 and press RETURN. The equivalent number of millimeters (25.4) is displayed and the program ends.

Now, run the program again and select option 20 (millimeters to inches). At the prompt, enter 25.4 and the answer, 1 (inch), should appear. If it doesn't, go back and check your typing carefully, especially the DATA statements.

Next month we'll analyze why some of our answers aren't what they appear to be. **G**

COMPUTE!'s Gazette is looking for utilities, games, applications, educational programs, and tutorial articles. If you've created a program that you think other readers might enjoy or find useful, send it, on tape or disk, to: **Submissions Reviewer, COMPUTE! Publications, P.O. Box 5406, Greensboro, NC 27403.** Please enclose an SASE if you wish to have the materials returned. Articles are reviewed within four weeks of submission.

machine language programming

Visible Division

Jim Butterfield

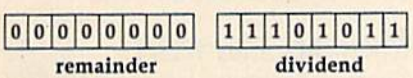
Division can be performed in a number of ways. Repeated subtraction is the simplest method and is easy to write. But the most efficient technique is true binary addition—and it's not hard to understand if you visualize it.

On early computers, division by binary addition was done from hardware. The programmer knew how the division worked by the setup the system required. Furthermore, if you could get computer time (which was rare, especially for such a "frivolous" activity), you could even single-step the hardware through this process.

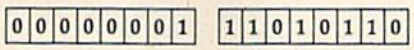
An Overview

To see this technique in action, let's step through an example. We'll divide 235 (the *dividend*) by 10 (the *divisor*). Remember, this takes place in binary; the bits do the job. Decimal 235 is binary 11101011. We would more commonly write this number as hexadecimal $EB (E for 1110; B for 1011). But this time, let's use binary so we can track the bits and see exactly what's happening.

Now for the visual side. We place the dividend in memory (it's a one-byte, or eight-bit, number) and attach, at its high-order end, a value of 0. This zero, called the *remainder*, has as many bytes as the divisor. (Sometimes, you need more than one zero byte here.) In this case, that's one byte, since the divisor, 10, is a one-byte number. Here's how it looks:

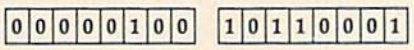


Let's shift the whole thing left by one bit. An ASL followed by an ROL instruction does the job. We'll come back here and repeat the shift operation until every bit of the dividend has been moved. After the first shift, we have:

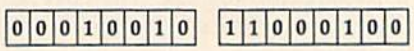


You can see how part of the dividend has moved into the remainder area. Go back and repeat the shift. Watch to see if the remainder becomes equal to 10 (our divisor) or more. This happens after three more shifts:

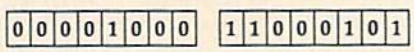
The remainder is now over 10 (it's 14, to be exact). In this case, subtract 10 from the remainder and set the low-order bit of the dividend to 1:



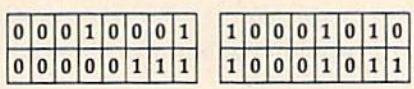
Keep going. Note that the bit we set at the bottom moves up along with everything else. Two more shifts, and the remainder exceeds 10 again:



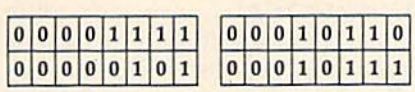
Repeat the subtraction and bit-set:



It all happens again on the next shift:



One last shift, one last subtraction, and all eight bits from the dividend have been processed:



We're finished. The memory that originally held the dividend now holds the quotient. The quotient, in this example, works out to 23. And the remainder is 5.

Putting It All Together

Let's see. We divided 235 by 10 and got a quotient of 23 and a remainder of 5. We did it by looping eight times, once for each bit of the original dividend. That's fast and easy.

Store the dividend (235) and the divisor (10) in locations $2081 (decimal 8321) and $2082 (decimal 8322), respectively. Then, enter the code below from a monitor:

```
2000  LDA #$00
2002  STA $2080   (put 0 in remainder
                   area)
2005  LDX #$00   (counter for shift
                   loop)
2007  ASL $2081
200A  ROL $2080   (do the "long" shift)
200D  LDA $2080   (is remainder...)
2010  CMP $2082   (...equal to/greater
                   than divisor?)
2013  BCC $2023   (no, skip next bit)
2015  SBC $2082   (subtract divisor)
2018  STA $2080
201B  LDA $2081   (put one bit...)
201E  ORA #$01    (...into bottom...)
2020  STA $2081   (...of dividend)
2023  INX         (count loop)
2024  CPX #$08    (reached maximum?)
2026  BCC $2007   (no, do it again)
2028  BRK         (STOP...or other
                   instruction)
```

Execute the routine. At this point, you could examine the contents of $2080 and $2081 and confirm that they contain the correct values for remainder and quotient. You might like to experiment to see what happens in unusual situations, such as division by 0.

I made a brief reference above to the occasional need for an extra remainder byte, one more than the number of bytes in the divisor. For example, when dividing by a one-byte number, when would we need to provide *two* zero bytes at the high end? A little thought turns up the answer: You need the extra byte when the high bit of the divisor is set. Thus, if we were dividing by 128 or greater, we'd make extra room. **G**

horizons

A Bit of History

Rhett Anderson

Here at *COMPUTE!'s Gazette*, we still get letters addressed to people who no longer work here. Although many letters come to Richard Mansfield, Todd Heimarck, Kevin Mykytyn, and Tom Halfhill, by far the greatest number come to Charles Brannon, COMPUTE!'s long-time program editor, who wrote *SpeedScript*, "Sprite Magic," "UltraFont," and many other programs and articles.

Since so many people still write to Charles, I thought I might take some time to take a look at the history of this column, which Charles pioneered.

Exploring the 64

The first issue of *Gazette* arrived in July 1983. There was no Horizons in that issue. Instead, there was a popular column written by Larry Isaacs called 64 Explorer. You might think it strange that the name of the 64 was in the title, but remember that at that time the Commodore VIC-20 was at least as popular as the 64. A similar column, VICreations, covered the goings-on in the VIC world. Although the machines shared many attributes, the hardware was different enough so that most programs could not be run on both systems. This set the stage for a rivalry between the two machines.

In October 1983 (Vol. 1, No. 4), 64 Explorer moved to *Gazette*'s sister magazine, *COMPUTE!*. This move was made to allow Larry Isaacs to cover topics which were even more technical than those he had covered in *Gazette*. To take its place, Horizons: 64 was created. The new column was pretty much free-ranging. One month it might have offered a technical discussion of how the 64's video output worked. The next month it might have carried minireviews of software. After that, maybe some programming tricks or hints.

In July 1984, Horizons: 64 became the more aesthetically pleasing Horizons 64 on the cover of *Gazette* and in the table of contents, although the head of the column itself remained the same. (Oddly, October 1984 saw the return of the title Horizons: 64.)

Goodbye VIC, Hello 128

The last VICreations appeared in December 1984. The following issue, Horizons: 64 became Horizons. The column became even more wide-ranging in its new incarnation. In fact, the January Horizons covered the VIC, Plus/4, Commodore 16, and Commodore 64. Charles said goodbye to the VIC and hello to the ill-fated Plus/4 and 16.

Horizons typically filled from two to five pages of *Gazette* in 1985. Increasingly, Charles used Horizons as a place to talk about the latest hardware for the 64. He covered digitizers, voice synthesizers, and other hardware.

Charles missed a column in August 1985 (he was engrossed in a *SpeedScript* modification). In September, he wrote about the 128 for the first time. In October, Horizons went down to one page—visually, it was very similar to the column you're reading now. The content still alternated between discussions of programming and close looks at new hardware.

In March and April 1986, there was no Horizons. Charles began writing the AmigaView column in *COMPUTE!*. Charles wrote his final Horizons in May. Assistant editor Todd Heimarck took over in June 1986 and kept the column even after becoming assistant editor of COMPUTE!'s now-defunct *Atari ST Disk & Magazine*. Charles left COMPUTE! in July, just a few weeks before I started working here.

Besides his work on Horizons, Todd also remained responsible for Feedback until he left COMPUTE!. Technical editor Patrick Parrish currently has the honor of compiling and editing Feedback, *Gazette*'s most popular column.

Computer Journalism

When Todd took over Horizons, it changed. Todd, well-versed in the technical details of the 64 and 128, covered the technical details of the machines in the column, but he approached Horizons from a new angle. Little by little, it became a home for essays about Commodore computers.

Todd's last Horizons column was published in July 1988. When Todd left, there was the expected minor battle over who would take over the column. Would it be me, or would it be Randy Thompson? In the interest of harmony, I suggested that we transform Hints & Tips into a programming column for Randy. Randy wanted to call the new column Voodoo, but cooler heads prevailed (actually, editor Lance Elko's cooler head), and The Programmer's Page was born.

To keep The Programmer's Page and Horizons from duplicating each other, I pledged to write essays of general interest and leave the programming to Randy.

Randy likes to point out that in reader surveys, The Programmer's Page shows a slight edge in popularity over Horizons. It seems I won the battle, but lost the war.

Where Are They Now?

Charles Brannon left COMPUTE! for a programming design job at Epyx. He is currently working for his family's business, writing accounting software. Todd Heimarck left for a job at Microsoft. He writes and edits software manuals. **G**

d'iversions

What's to Say About Computers?

Fred D'Ignazio

I was brushing my teeth this morning, looking in the mirror and wondering how many times I had stuck a toothbrush in my mouth since I was a kid. As I scrubbed, I was kind of analyzing why I was so good about remembering to brush my teeth each day. Maybe it was because my mother dragged me into the bathroom every morning and night when habits get "wired in."

Then I decided: The real reason I brush my teeth is because *my mouth tastes so good when I'm done.*

This thought made me wonder why I do a lot of things. Why do I eat? Why do I risk my life jogging on Michigan's snow-covered roads? Why do I write this column each month? On the surface, it's easy to answer those questions. I eat to stay alive, I run to keep my blood pressure down, and I do my work because I have to pay for diaper bills next month when my new baby blows into town.

Labor of Love

Underneath these lovely rational reasons is a truer, more honest answer: I do these things just for the joy of doing them. I don't do them for some payoff down the road. I do them because they give me pleasure right at this moment.

The same is true for computing. I spend 90 percent of my time trying to justify computers—to myself and other people—in terms of their practicality. But I am not a practical man. (Just ask my father.) I wouldn't touch computers if the only thing they did was get my life more organized or help me pay my bills on time. What draws me to them is their charm, their charisma, their . . . lovableness.

Sure I use computers to do work. Don't you? Doesn't everybody who uses a computer at all? But it's not the work that brings me back. There is something indescribably delicious about the way it feels to work with computers. That's the hook. And whatever it is, it grabs me again and again.

No More Explanations

I was home over the holidays with my folks in Pennsylvania. We always go home and stay with my wife's family for a week and with my family for a week. While we're there, we catch seven different kinds of flu, we stay up talking all night until we're completely run down, and we spend every waking moment stuffing our faces. All in all, it's a fabulous time.

This year, just as he does every year, my dad asked me how I was doing in my career in computers. Years ago, when I was young and chipper, I used to sit down with Dad and earnestly describe my latest projects. But now I don't even try, because Dad already knows what I do: I work with computers. And, to Dad, computers are computers. Computers send you your monthly credit card bills. Computers book your flights to Cancún, Nassau, and Newark. Dad knows what computers look like because he watches TV. They're grayish sorts of machines with cathode ray tubes which display symbols of the Greek alphabet. They have whirling tape drives and printers which spew out accountants' ledgers and *Reader's Digest* sweepstake ads. So why should I spend time telling Dad about what I did this year? What's to say about computers?

And yet I want to say something. I want to tell my dad that *my* computers are not the same as *his* computers. I want to tell him how they've changed during the last ten years. There are now two kinds of computers in the world—the big guys and the little guys. The big guys are much as my father has imagined. But the little guys?

Just think, Dad, you know that giant computer you picture in your mind? It has shrunk to where it can fit on top of my desk. And it's ten times as fast as you think it is. And it has made my house different from your house, my life different from yours. It's changing the way I write, the way my children learn, the way my family plays, and the way we think of information, culture, and knowledge. It's a *personal* computer, not a data processing device; it's a roadway into a new world of electronic possibilities.

Dad, I know you picture me each day, working like a computer technician in pinstripes, writing programs and carrying around reels of tape and punch cards. But that was me ten years ago. These days I'm wearing slippers, sipping tea as I sit at my desk in corduroys, flannel shirt, and suspenders.

You see me working alone, a solitary hermit. But thanks to my computer, I feel like I'm in Grand Central Station. I have my computer plugged into my phone, and I send and receive notes from family, friends, and business associates at all hours, day or night. I shop, read news, and buy airplane tickets—all while I sit at my computer. I play games long-distance with people I've never met. I can fax complete documents into anyone's office, complete with my letterhead and graphics. My son sits at my computer and "plays" classical music. My daughter travels around the world chasing a thief named Carmen. The computer is our bulletin board, typewriter, game machine, and piano. It's our telephone, post office, and travel bureau.

I want to tell my dad all these things. But usually I just smile kind of Mona Lisa–style and say, "You know computers, Dad. What's to say about computers?" **G**

THE geos column

File Converter

Jim Tubbs

GEOS programmers can easily convert their files to GEOS format using this time-saving utility. "File Converter" takes a standard Commodore file and attaches the header block and directory information that GEOS requires.

Unless you own Berkeley Softworks' *geoProgrammer*, the only way you can create a GEOS file is to use a conversion program such as *Gazette*'s "GeoConverter." And, as any GEOS programmer knows, porting a simple application from assembly language to GEOS without *geoAssembler* is a time-consuming process.

You must assemble your source code to disk, load and run the conversion program, boot GEOS, and then test your program. If it crashes (as mine often does), then you must reload your assembler, reassemble your program, reboot the conversion program, reboot GEOS . . . well, you get the idea.

Using "File Converter," you can convert non-GEOS files to GEOS format simply by double-clicking the File Converter icon and answering a few simple questions—all from within the GEOS environment.

Typing It In

Like all true GEOS applications, File Converter is written in machine language. Type it in with "MLX," the machine language entry program found elsewhere in this issue. (Commodore 128 owners must use 64 mode when typing in this program.) When MLX prompts you, respond with the values given below.

Starting address: 1503
Ending address: 1F9A

Type in the data for Program 1. After you've finished typing, save two copies to a GEOS work disk—one with the name CONVERTER .ML and the other with the name FILE CONVERTER. One of these files will be converted with GeoConverter; the other will remain in MLX format.

Now type in Program 2, "GeoConverter." (Again, 128 owners must use 64 mode.) Use "The Automatic Proofreader," found elsewhere in this issue, when you enter this program. GeoConverter is used to make File Converter into a GEOS file (you can't use File Converter to convert itself). Save a copy of GeoConverter to your GEOS work disk.

Now, run Program 2. You'll be prompted for a filename. Type *FILE CONVERTER*. GeoConverter converts your file into a GEOS file.

Conversion Time

To activate File Converter, boot GEOS and double-click the program's icon. When File Converter appears on the screen, type the name of the file you wish to load. Typed letters appear in the program's filename box. Don't let the absence of a cursor here concern you. If you make a typing mistake, simply press the DELete key and try again.

If you click the filename box, the computer will ask you for the name of the program's author. If you're creating a GEOS data file, you can enter the name of the parent application's disk instead. Press RETURN to go back to filename mode.

When the filename (and, optionally, the author/application disk name) is entered, insert the disk that contains the file that you're about to convert and then press RETURN. Your file is loaded into memory and certain file information is displayed onscreen. You don't have to know or understand this information; it's provided for your convenience.

Before you can save the converted file, you must specify a file type. To do so, simply click on the appropriate box: BASIC, ASSEMBLY, DATA, SYSTEM, ACCES., APPLIC., AUTO-EXE, FONT, PRINTER, INPUT, DISK DEV., and SYS-BOOT.

The first three options—BASIC, ASSEMBLY, and DATA—attach a header block to files that are designed to operate independently of GEOS. This header block is useful in providing GEOS with additional file information. Such a file can still be loaded and executed under the normal 64 operating system. The remaining options are for GEOS-specific files only.

When you're satisfied with your choice, select the SAVE icon. File Converter saves the converted file and returns you to the program. Select CANCEL to exit to the deskTop.

Additional Features

If you like, you may load a file from one disk and then save it to another. After you select a file type, click DISK to change the disk in the current drive or click DRIVE to change the current disk drive (assuming you have more than one drive connected to your system). Click SAVE to save the file to the new disk.

Saving a file under a different filename is easy, too. Just before you select a file type, press the DELete key and change the filename. Do *not* press RETURN; if you press RETURN, File Converter will attempt to load another file. Now, select a file type and click on SAVE. Your converted file is now saved to disk using the name you've just entered.

See program listings on page 74. **G**

Coming Next Month—

A first look at a major upgrade:

GEOS 128—Version 2.0.

BEFORE TYPING . . .
Before typing in programs, please refer to "How to Type In COMPUTE!'s Gazette Programs," elsewhere in this issue.

Comparator

See instructions in article on page 51 before typing in.

```
C000:A9 00 85 13 A9 00 8D A0 41
C008:C3 8D A1 C3 20 5F C1 20 61
C010:5F C1 20 5F C1 A0 00 20 5C
C018:52 C1 20 5F C1 20 5F C1 3C
C020:A0 26 20 52 C1 A0 2E 20 B1
C028:52 C1 20 F9 AB A0 00 B9 80
C030:00 02 F0 07 99 77 C3 C8 BB
C038:4C 2F C0 99 77 C3 8C 9A DB
C040:C3 A0 26 20 52 C1 A0 3C A9
C048:20 52 C1 20 F9 AB A0 00 68
C050:B9 00 02 F0 07 99 87 C3 6F
C058:C8 4C 50 C0 99 87 C3 8C 66
C060:9B C3 20 5F C1 A0 48 20 DB
C068:52 C1 20 F9 AB A0 00 B9 C0
C070:00 02 8D 97 C3 C9 53 F0 7A
C078:0C C9 50 F0 08 A9 91 20 B5
C080:D2 FF 4C 65 C0 20 5F C1 52
C088:20 5F C1 A0 68 20 52 C1 5E
C090:20 5F C1 AD 97 C3 C9 53 BF
C098:F0 10 A9 04 AA A0 FF 20 04
C0A0:BA FF A9 00 20 BD FF 20 CC
C0A8:C0 FF A9 03 AE A2 C3 A8 20
C0B0:20 BA FF AD 9B C3 A2 87 84
C0B8:A0 C3 20 BD FF 20 C0 FF 5D
C0C0:A2 03 20 C6 FF 20 CF FF E4
C0C8:20 CF FF 20 CC FF A9 01 0B
C0D0:85 FB A9 08 85 FC A0 01 2C
C0D8:B1 FB F0 0E 20 93 C1 A9 AD
C0E0:A3 85 FD A9 C3 85 FE 4C 6E
C0E8:ED C0 4C 3A C1 20 D8 C1 C0
C0F0:C9 02 F0 10 C9 03 F0 06 39
C0F8:20 2F C2 4C 11 C1 20 52 95
C100:C2 4C 11 C1 20 75 C2 C9 5C
C108:00 F0 3E 20 2F C2 20 52 A8
C110:C2 AD A0 C3 0D A1 C3 C9 F0
C118:03 F0 0B C9 01 F0 DF C9 AC
C120:02 F0 D5 4C ED C0 A9 03 29
C128:20 C3 FF AD 97 C3 C9 50 37
C130:D0 08 20 20 C2 A9 04 20 09
C138:C3 FF 20 5F C1 A0 00 98 C0
C140:99 00 02 C8 C0 57 D0 F8 5B
C148:60 20 93 C1 20 7A C1 4C 4D
C150:11 C1 B9 02 C3 F0 07 20 34
C158:D2 FF C8 4C 52 C1 60 A9 27
C160:0D 20 D2 FF 60 8C 98 C3 F6
C168:A2 04 A9 00 18 20 90 AA 80
C170:AC 98 C3 20 52 C1 20 CC 91
C178:FF 60 A0 01 B1 FB 48 88 CE
C180:B1 FB 85 FB 68 85 FC A0 40
C188:01 B1 FB D0 05 A9 01 8D E3
C190:A0 C3 60 A0 00 A2 03 20 1C
C198:C6 FF 20 CF FF 99 A3 C3 F1
C1A0:C8 C0 04 D0 F5 A0 01 B9 34
C1A8:A3 C3 F0 15 A0 04 20 CF 83
C1B0:FF F0 07 99 A3 C3 C8 4C F4
C1B8:AE C1 99 A3 C3 20 CC FF A9
C1C0:60 A9 02 8D A1 C3 4C BD 6A
C1C8:C1 A2 04 A9 00 18 20 90 22
C1D0:AA 20 88 C2 20 CC FF 60 83
C1D8:A0 02 B1 FB D1 FD D0 0A 55
C1E0:C8 B1 FB D1 FD D0 03 A9 B4
C1E8:02 60 A0 03 B1 FB D1 FD E8
C1F0:F0 0D B1 FB 38 F1 FD B0 5C
C1F8:03 A9 01 60 A9 03 60 A0 49
C200:02 B1 FB 38 F1 FD B0 F4 D3
C208:4C F9 C1 AD 97 C3 C9 50 F4
C210:D0 04 20 C9 C1 60 20 88 F7
C218:C2 20 5F C1 20 5F C1 60 71
C220:A2 04 A9 00 18 20 90 AA 3A
C228:20 5F C1 20 CC FF 60 A0 97
C230:02 B1 FB 8D 9E C3 C8 B1 C2
C238:FB 8D 9F C3 A5 FB 8D 9C 24
C240:C3 A5 FC 8D 9D C3 A0 75 3C
C248:20 EA C2 20 0B C2 20 7A 11
C250:C1 60 A0 02 B1 FD 8D 9E 42
C258:C3 C8 B1 FD 8D 9F C3 A9 24
C260:A3 8D 9C C3 A9 C3 8D 9D FF
C268:C3 A0 85 20 EA C2 20 0B 58
C270:C2 20 93 C1 60 A0 04 B1 2D
C278:FB D1 FD D0 08 C8 C9 00 34
C280:D0 F5 A9 00 60 A9 01 60 2D
C288:AD 9C C3 85 5F AD 9D C3 8D
C290:85 60 A0 01 84 0F 20 D7 8D
C298:AA A0 03 84 49 AD 9F C3 48
C2A0:AE 9E C3 20 CD BD A9 20 78
C2A8:A4 49 29 7F 20 47 AB C9 2F
C2B0:22 D0 06 A5 0F 49 FF 85 B9
C2B8:0F C8 F0 04 B1 5F D0 01 04
C2C0:60 10 E9 C9 FF F0 E5 24 08
C2C8:0F 30 E1 38 E9 7F AA 84 C8
C2D0:49 A0 FF CA F0 08 C8 B9 C2
C2D8:9E A0 10 FA 30 F5 C8 B9 2C
C2E0:9E A0 30 C4 20 47 AB D0 76
C2E8:F5 60 AD 97 C3 C9 50 D0 67
C2F0:0D 8C 99 C3 20 20 C2 AC 43
C2F8:99 C3 20 65 C1 60 20 52 B8
C300:C1 60 42 41 53 49 43 20 43
C308:43 4F 4D 50 41 52 41 54 DD
C310:4F 52 20 20 20 20 20 20 BB
C318:20 20 20 20 20 20 20 20 9F
C320:20 20 20 20 20 20 20 00 87
C328:50 52 4F 47 52 41 4D 00 FC
C330:20 23 31 20 28 4D 45 4D 07
C338:4F 52 59 29 20 00 20 23 1E
C340:32 20 28 44 49 53 4B 29 89
C348:20 00 4C 49 53 54 20 54 7E
C350:4F 20 53 43 52 45 45 4E A6
C358:20 4F 52 20 50 52 49 4E BC
C360:54 45 52 20 28 53 2F 50 EC
C368:29 00 43 4F 4D 50 41 52 62
C370:49 4E 47 2E 2E 2E 00 20 46
C378:20 20 20 20 20 20 20 20 FF
C380:20 20 20 20 20 20 20 20 08
C388:20 20 20 20 20 20 20 20 10
C390:20 20 20 20 20 20 20 00 F7
C398:00 00 00 00 00 00 00 00 20
C3A0:00 00 08 00 00 00 00 00 29
```

Odometer

See instructions in article on page 54 before typing in.

```
CB20:A2 CC EC 33 03 F0 76 AD 83
CB28:8F 02 AE 90 02 A0 33 8D 6D
CB30:CB CE 8E CC CE B9 00 03 60
CB38:99 ED CE 88 10 F7 78 20 EB
CB40:8A FF 20 53 E4 58 A9 A0 D2
CB48:A2 E0 A0 00 85 FC 86 FE A9
CB50:84 FB 84 FD B1 FB 91 FB 36
CB58:B1 FD 91 FD C8 D0 F5 E6 B6
CB60:FC E6 FE D0 EF A9 4C A2 7E
CB68:A0 A0 CD 8D F9 F4 8D 2E F7
CB70:F6 8E 2F F6 8C 30 F6 A9 39
CB78:C3 8D FA F4 A9 CC 8D FB 9B
CB80:F4 A9 4F 20 D2 FF A9 4E 21
CB88:20 D2 FF A9 28 48 A9 CC 02
CB90:48 A9 F7 48 A9 EF A2 CC 59
CB98:A0 CB 4C D2 CB AD CB CE A5
CBA0:AE CC CE A0 33 78 8D 8F CC
CBA8:02 8E 90 02 B9 ED CE 99 D3
CBB0:00 03 88 10 F7 58 A9 4F DE
CBB8:20 D2 FF A9 46 20 D2 FF 08
CBC0:20 D2 FF A9 A5 48 A9 F4 4E
CBC8:48 A9 ED 48 A9 8B A2 F5 E7
CBD0:A0 E3 8D 00 03 8C 01 03 B2
CBD8:68 8D 32 03 68 8D 31 03 5D
CBE0:68 8D 30 03 8E 33 03 A9 37
CBE8:00 8D 00 02 4C 1F CE AD 2E
CBF0:00 02 CE 00 02 C9 40 D0 6B
CBF8:23 20 42 CE 20 5B CE A2 0E
CC00:0F 20 C6 FF 20 CF FF C9 0C
CC08:0D F0 06 20 D2 FF 4C 04 5A
CC10:CC A9 0F 20 C3 FF 20 CC 89
CC18:FF 4C 74 A4 86 FB A2 CC D3
CC20:20 8B CB A6 FB 4C 8B E3 9C
CC28:AE 00 02 E0 93 F0 07 E0 B6
CC30:95 F0 03 4C A5 F4 8D BF D1
CC38:CE 20 2A CE 20 42 CE A9 C4
CC40:EA 8D 28 03 A9 0D 20 D2 7C
CC48:FF A9 24 8D 00 02 A9 3A 3F
CC50:8D 01 02 A9 05 A2 08 A0 2F
CC58:00 20 BA FF A5 B7 18 69 F6
CC60:02 A2 00 A0 02 20 BD FF B9
CC68:20 C0 FF A2 05 20 C6 FF A2
CC70:20 CF FF 20 CF FF 20 CF 9E
CC78:FF 20 CF FF 20 CF FF 48 9C
CC80:20 CF FF A8 68 AA A5 90 72
CC88:D0 16 98 20 CD BD A9 20 FD
CC90:20 D2 FF 20 CF FF D0 F8 0A
CC98:A9 0D 20 D2 FF 4C 76 CC 66
CCA0:A9 05 20 C3 FF 20 CC FF AA
CCA8:A9 93 A2 22 8D 00 02 8E 71
CCB0:01 02 20 0E CE 20 36 CE 62
CCB8:A9 ED 8D 28 03 AD BF CE F3
CCC0:4C A5 F4 A5 90 D0 1A AD 8C
CCC8:CD CE D0 0D EE CD CE A9 DD
CCD0:9D A0 CE 20 1E AB 20 E7 05
CCD8:CC EE CE CE D0 03 20 E7 16
CCE0:CC 20 E1 FF 4C FC F4 E6 4C
CCE8:FD D0 02 E6 FE 20 03 CE B1
CCF0:A5 FE A6 FD 4C F1 CD AE 46
CCF8:00 02 E0 94 F0 03 4C ED 92
CD00:F5 20 42 CE A9 EA 8D 28 10
CD08:03 20 2A CE 20 5B CE A2 0E
CD10:0F 20 C9 FF A9 55 20 D2 2A
CD18:FF A9 3B 20 D2 FF A9 0D 7E
CD20:20 D2 FF 20 CC FF A9 0F 4B
CD28:20 C3 FF A9 05 A2 08 A0 C2
CD30:00 20 BA FF A9 05 A2 6B 3D
CD38:A0 CE 20 BD FF 20 C0 FF B9
CD40:A2 05 20 C6 FF A9 23 85 51
CD48:FB 20 CF FF C6 FB D0 F9 A5
CD50:85 FB 20 CF FF 85 FC A9 68
CD58:05 20 C3 FF 20 CC FF 20 4B
CD60:36 CE A9 ED 8D 28 03 A9 9B
CD68:01 A6 C1 A4 C2 85 02 86 67
CD70:FD 84 FE A9 00 A2 FC 8D B8
CD78:C6 CE E6 FD D0 02 E6 FE 43
CD80:A5 FD C5 AE D0 06 A5 FE FA
CD88:C5 AF F0 0E CA D0 EB A2 06
CD90:FE E6 02 D0 E5 EE C6 CE F9
CD98:D0 E0 20 0E CE 4C ED F5 33
CDA0:8C C9 CE A5 90 D0 1A AD D2
CDA8:CD CE D0 0D EE CD CE A9 BF
CDB0:70 A0 CE 20 1E AB 20 CA 33
CDB8:CD EE CE CE D0 03 20 CA 5B
CDC0:CD AC C9 CE 20 E1 FF 4C 69
CDC8:31 F6 E6 FD D0 02 E6 FE D2
CDD0:A5 FB D0 02 C6 FC C6 FB 2C
CDD8:AD C6 CE A6 02 20 CD BD 2B
CDE0:20 03 CE A5 FE A6 FD 20 30
CDE8:CD BD 20 03 CE A5 FC A6 BC
CDF0:FB 20 CD BD A9 20 20 D2 09
CDF8:FF A9 0D 20 D2 FF A9 91 1E
CE00:4C D2 FF A9 20 A2 0E 20 DA
CE08:D2 FF CA D0 FA 60 A9 04 26
CE10:A2 00 8D CE CE 8E CD CE B8
CE18:86 FD 86 FE A9 35 2C A9 5D
CE20:37 A2 2F 78 85 01 86 00 AC
CE28:58 60 A0 16 B9 AC 00 99 99
CE30:CF CE 88 10 F7 60 A0 16 14
CE38:B9 CF CE 99 AC 00 88 10 A0
CE40:F7 60 A9 00 85 90 A9 08 F0
CE48:20 0C ED A9 F0 20 B9 ED BA
CE50:A5 90 10 D5 68 68 A2 05 73
CE58:4C 37 A4 A9 0F A8 A2 08 81
CE60:20 BA FF A9 00 20 BD FF 53
CE68:4C C0 FF 24 3A 55 3D 55 95
CE70:0D 0D 12 50 52 4F 47 20 9D
CE78:4C 45 4E 47 54 48 20 2A F9
CE80:20 42 4C 4F 43 4B 53 20 4B
CE88:53 41 56 45 44 20 2A 20 56
CE90:42 4C 4F 43 4B 53 20 46 AE
CE98:52 45 45 0D 00 0D 0D 12 8A
CEA0:2A 20 42 4C 4F 43 4B 53 D9
```

```
CEA8:20 4C 4F 41 44 45 44 20 47
CEB0:28 56 45 52 49 46 49 45 01
CEB8:44 29 20 2A 0D 0D 00 41 47
CEC0:2E 48 2E 53 2E 00 00 00 F3
```

Sprite Fader

See instructions in article on page 50 before typing in.

Program 1: Sprite Fader

```
1300:4C 06 13 4C BA 13 8D E6 19
1308:15 8E E5 15 8C E4 15 A9 36
1310:00 8D 18 D4 85 FB A8 A9 01
1318:0E 85 FC A9 00 91 FB C8 E7
1320:D0 F9 E6 FC A5 FC C9 10 9E
1328:90 F1 A5 F1 A0 07 99 27 62
1330:D0 88 10 FA A9 FF 8D 15 10
1338:D0 A9 00 8D 00 FF AD E4 4A
1340:15 C9 02 B0 17 A9 18 8D CB
1348:E7 15 AD E4 15 F0 02 A9 C5
1350:FF 8D 17 D0 A9 00 8D 1D 4F
1358:D0 4C 77 13 A2 FF C9 03 C5
1360:F0 03 A0 00 2C A0 FF A9 61
1368:00 8D 00 FF 8E 1D D0 8C 09
1370:17 D0 A9 30 8D E7 15 A0 65
1378:00 AD E6 15 99 D7 11 C8 4F
1380:C8 C0 11 90 F7 A0 00 84 2D
1388:FA A2 00 8E E6 11 AD E5 7A
1390:15 99 D6 11 C8 C8 E8 18 E6
1398:6D E7 15 8D E5 15 90 02 91
13A0:E6 FA A5 FA F0 0F BD 71 0E
13A8:15 8D E8 15 AD E6 11 0D 63
13B0:E8 15 8D E6 11 C0 10 90 EC
13B8:D5 60 A9 FF 8D 0F D4 A9 13
13C0:81 8D 12 D4 A9 00 8D E9 EC
13C8:15 8D EB 15 A8 99 00 16 6D
13D0:99 00 17 C8 D0 F7 20 80 5A
13D8:03 20 EF 77 A5 49 85 FD 59
13E0:A5 4A 85 FE A9 FD A2 01 98
13E8:A0 00 20 74 FF 85 FA C8 7F
13F0:A9 FD A2 01 20 74 FF 85 28
13F8:FB C8 A2 01 A9 FD 20 74 AD
1400:FF 85 FC A5 FA D0 05 A2 4B
1408:0E 6C 00 03 C9 19 B0 F7 8E
1410:AC E9 15 A9 FB A2 01 20 D2
1418:74 FF 20 5C 15 C8 8C E9 13
1420:15 48 A9 00 85 FD A9 D0 62
1428:85 FE 68 18 0A 90 02 E6 DE
1430:FE 18 0A 90 02 E6 FE 18 E9
1438:0A 90 02 E6 FE 85 FD A9 EB
1440:01 8D 00 FF AC EB 15 B9 45
1448:A9 15 8D 63 14 C8 B9 A9 53
1450:15 C8 8C EB 15 8D 64 14 41
1458:A0 00 8C EA 15 B1 FD AE 2B
1460:EA 15 9D C2 17 E8 E8 E8 3A
1468:8E EA 15 C8 C0 08 90 ED F6
1470:AC E9 15 C4 FA D0 99 A9 50
1478:00 8D 00 FF 8D DB 15 8D 97
1480:E0 15 8D DE 15 8D DF 15 B1
1488:AD DE 15 18 69 01 8D DE AC
1490:15 90 03 EE DF 15 AD DF 45
1498:15 C9 07 90 03 4C 5B 15 BC
14A0:AC E0 15 C0 10 90 17 A0 97
14A8:00 8C E0 15 AD DB 15 18 80
14B0:69 01 8D DB 15 C9 18 90 CD
14B8:70 A9 00 8D DB 15 B9 79 7C
14C0:15 85 FB C8 B9 79 15 85 44
14C8:FC C8 8C E0 15 A5 FB 85 FD
14D0:FD A5 FC 18 69 08 85 FE F7
14D8:AC DB 15 B9 89 15 A8 B1 30
14E0:FB 8D DA 15 8C DC 15 B1 CA
14E8:FD 8D E1 15 20 35 15 A8 A9
14F0:8C DD 15 B9 71 15 8D D9 E9
14F8:15 AD DA 15 2D D9 15 8D 4C
1500:E2 15 AD E1 15 2D D9 15 DA
1508:CD E2 15 F0 30 2D E1 15 92
1510:F0 03 4C 2C 15 A9 FF 38 47
1518:ED D9 15 8D D9 15 AD DA 84
1520:15 2D D9 15 AC DC 15 91 41
1528:FB 4C 88 14 AD DA 15 0D C5
1530:D9 15 4C 24 15 AD 1B D4 C2
1538:C9 08 B0 F9 60 AD DA 15 83
1540:CD E1 15 D0 03 4C 88 14 E7
1548:AC DD 15 C8 C0 08 90 02 B8
1550:A0 00 8C DD 15 B9 71 15 C1
1558:4C F6 14 60 48 29 80 8D 64
1560:E8 15 68 29 3F 48 AD E8 43
1568:15 F0 04 68 09 40 60 68 D2
1570:60 01 02 04 08 10 20 40 8C
1578:80 00 0E 40 0E 80 0E C0 F7
1580:0E 00 0F 40 0F 80 0F C0 F0
1588:0F 09 02 17 07 15 0B 00 D0
1590:13 03 10 11 01 05 12 0F 67
1598:0E 04 14 06 0D 0C 08 0A 60
15A0:16 FF FE FC F8 F0 E0 C0 93
15A8:80 00 16 01 16 02 16 40 0B
15B0:16 41 16 42 16 80 16 81 7D
15B8:16 82 16 C0 16 C1 16 C2 04
15C0:16 00 17 01 17 02 17 40 18
15C8:17 41 17 42 17 80 17 81 40
15D0:17 82 17 C0 17 C1 17 C2 C6
15D8:17 00 00 00 00 00 00 00 8E
```

Program 2: Sprite Fader Demo

```
FH 10 REM COPYRIGHT 1989 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
SR 20 BANK15:IFPEEK(4864)<>76T
      HENBLOAD"FADER.ML"
AP 30 COLOR0,1:COLOR4,1:PRINT"
      {CLR}{YEL}{3 SPACES}COPY
      RIGHT 1989 COMPUTE! PUB.
      , INC.":PRINTTAB(11)"ALL
       RIGHTS RESERVED":SLEEP2
RS 40 PRINT"{CLR}{CYN}{3 DOWN}
      {3 RIGHT}COMPUTE'S GAZET
      TE":PRINT"{3 RIGHT}PRESE
      NTS...{3}"
SQ 50 SYS4864,140,80,3
GX 60 FORI=1TO6:READA$:SYS4867
      ,,,,,A$:NEXT
EK 70 SCNCLR
DM 80 A$=" ":SYS4867,,,,,A$
KR 90 PRINT"{CLR}{8}{DOWN}
      {RIGHT}FOUR TEXT SIZES..
      ."
QK 100 TX$="THIS IS SIZE":TB(0
       )=110:TB(1)=110:TB(2)=7
       0:TB(3)=70
SB 110 FORI=0TO3:SYS4864,140,T
       B(I),I:A$=TX$+STR$(I):S
       YS4867,,,,,A$
FP 120 SLEEP1:A$=" ":SYS4867,,
       ,,,A$:NEXT
CH 130 PRINT"{CLR}"
QX 140 A$=" ":SYS4867,,,,,A$
CB 150 PRINT"{CLR}{DOWN}
       {RIGHT}AND AN ARRAY OF
       {SPACE}COLORS!"
RE 160 FORI=1TO5:POKE241,I:SYS
       4864,130,80,2:A$="COLOR
       FUL TEXT":SYS4867,,,,,A
       $
DJ 170 A$=" ":SYS4867,,,,,A$:N
       EXT
JS 180 PRINT"{CLR}{DOWN}{CYN}A
       ND MOVEMENT TOO!{2}"
SP 190 SYS4864,150,0,3
QK 200 A$="MOVING TITLES ARE E
       ASY!"
XS 210 FORI=1TO8:MOVSPRI,270#3
       :NEXT
MQ 220 SYS4867,,,,,A$
GS 230 GOSUB440
HP 240 A$="AND MAY BE CHANGED"
       :SYS4867,,,,,A$
XB 250 GOSUB440
AS 260 A$="WHILE TEXT IS MOVIN
       G!":SYS4867,,,,,A$
HD 270 GOSUB440
JG 280 A$=" ":SYS4867,,,,,A$
XD 290 FORI=1TO8:MOVSPRI,0#0:N
       EXT
GA 300 SYS4864,240,110,0
CB 310 FORI=1TO8:MOVSPRI,0#1:N
       EXT
EG 320 PRINT"{CLR}{DOWN}VERTIC
       AL MOVEMENT TOO!"
FF 330 FORI=1TO2:A$="FADING IN
        AND OUT!"
CH 340 SYS4867,,,,,A$
KR 350 A$=" "
ME 360 SYS4867,,,,,A$
KK 370 NEXT
XP 380 PRINT"{CLR}":FORI=1TO8:
       MOVSPRI,0#0:NEXT
AK 390 SYS4864,140,88,0
JS 400 A$="PRESS ANY KEY TO RE
       START"
DP 410 SYS4867,,,,,A$
GS 420 A$=" ":SYS4867,,,,,A$
JF 430 GETA$:IFA$=""THEN400:EL
       SERUN
PP 440 WINDOW0,23,39,24,1:PRIN
       TTAB(8)"{YEL}PRESS ANY
       {SPACE}KEY TO CONTINUE"
       ;
XM 450 GETKEYA$:PRINT"{CLR}";:
       WINDOW0,0,39,24:RETURN
RS 460 DATA "SPRITE FADER"
RR 470 DATA " THE SUPER"
SS 480 DATA "{2 SPACES}ALL-ML"
BQ 490 DATA "{2 SPACES}UTILITY
       "
CG 500 DATA "{2 SPACES}FOR YOU
       R"
RP 510 DATA "COMMODORE 128!"
```

Power BASIC: Italics

Article on page 45.

Program 1: Italics—64 Version

```
EM 10 REM COPYRIGHT 1989 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED.
EC 20 POKE53280,14:POKE53281,6
SK 30 SA=832:IS=52:IE=252
EJ 40 T=SA:CK=0
GP 50 READA:IF A=-1 THEN 70
FS 60 POKE T,A:T=T+1:CK=CK+A:G
      OTO50
PP 70 IF CK<>11204 THEN PRINT"
      ERROR IN DATA":END
RF 80 T=SA+35:H=INT(T/256):L=T
      -H*256
JE 90 POKE SA+24,L:POKESA+29,H
XJ 100 POKE SA+63,IE:POKE SA+1
       2,IS:POKE SA+78,IS
HF 110 SYS SA:PRINT"{CLR}{7}CO
       PYRIGHT 1989"
JX 120 PRINT"COMPUTE! PUBLICAT
       IONS, INC.":PRINT"ALL R
       IGHTS RESERVED."
QR 130 DATA 120,169,127,141,13
       ,220,169,1,141,26
QE 140 DATA 208,169,52,133,176
       ,141,18,208,169,27
AB 150 DATA 141,17,208,169,99,
       141,20,3,169,3
DG 160 DATA 141,21,3,88,96,169
       ,1,141,25,208
BJ 170 DATA 173,22,208,201,201
       ,208,7,169,204,141
JP 180 DATA 22,208,208,3,206,2
       2,208,165,176,24
AS 190 DATA 105,2,201,252,176,
       11,133,176,141,18
AC 200 DATA 208,104,168,104,17
       0,104,64,169,52,133
EF 210 DATA 176,141,18,208,169
       ,204,141,22,208,76
EM 220 DATA 49,234,-1
```

Program 2: Italics—128 Version

```
HJ 10 REM COPYRIGHT 1989 COMPU
      TE! PUBLICATIONS, INC.
      {2 SPACES}ALL RIGHTS RES
      ERVED.
BE 20 POKE53281,11:POKE53280,1
      3
HK 30 BANK15:SA=4864:IS=53:IE=
      250
EJ 40 T=SA:CK=0
GP 50 READA:IFA=-1 THEN 70
FS 60 POKE T,A:T=T+1:CK=CK+A:G
      OTO50
RM 70 IF CK<>14230 THEN PRINT"
      ERROR IN DATA":END
RF 80 T=SA+35:H=INT(T/256):L=T
      -H*256
JE 90 POKE SA+24,L:POKE SA+29,
      H
SG 100 POKE SA+81,IE:POKE SA+9
       6,IS:POKE SA+12,IS
XE 110 SYS SA:PRINT"{CLR}{6}CO
       PYRIGHT 1989":PRINT"COM
       PUTE PUBLICATIONS, INC.
       ":PRINT"ALL RIGHTS RESE
       RVED."
JQ 120 DATA 120,169,127,141,13
       ,220,169,1,141,26
BE 130 DATA 208,169,53,133,176
       ,141,18,208,169,27
QJ 140 DATA 141,17,208,169,35,
       141,20,3,169,19
HC 150 DATA 141,21,3,88,96,216
       ,169,1,141,25
EF 160 DATA 208,173,22,208,133
       ,177,201,200,208,6
BD 170 DATA 169,201,133,177,20
       8,2,198,177,173,18
SR 180 DATA 208,197,176,240,24
       9,160,7,136,208,253
FG 190 DATA 165,177,141,22,208
       ,165,176,24,105,4
JQ 200 DATA 201,250,176,11,133
       ,176,141,18,208,141
MA 210 DATA 52,10,76,51,255,16
       9,53,133,176,141
JP 220 DATA 18,208,169,201,141
       ,22,208,76,101,250,-1
```

BASIC 10

See instructions in article on page 46 before typing in.

```
0801:0C 08 C5 07 9E 20 32 30 4C
0809:37 34 00 00 00 E0 9A 83 FD
0811:A4 31 99 47 9A FD 99 93 FA
0819:9A A9 00 85 5F 85 5A 85 84
0821:58 A9 A0 85 60 A9 C0 85 E4
0829:5B 85 59 20 BF A3 A9 3B 90
0831:85 5F A9 09 85 60 A9 A4 47
0839:85 5A A9 0F 85 5B A9 69 1F
0841:85 58 A9 9F 85 59 20 BF EA
0849:A3 A9 99 8D 84 02 20 BF CD
0851:E3 A9 4C 8D A5 B0 8D C4 EF
0859:B5 8D 43 B1 8D FF AE 8D 82
0861:FC BC EA EA EA A9 D2 8D 5C
0869:75 A8 A9 0B 8D 76 A8 A9 85
0871:9C 8D 22 A0 A9 9B 8D 23 7B
0879:A0 A9 D6 8D 24 A0 A9 9C 8B
0881:8D 25 A0 A9 CD 8D A6 B0 F2
0889:A9 9B 8D A7 B0 A9 88 8D 4C
0891:44 B1 A9 9C 8D 45 B1 A9 BD
0899:9E 8D C5 B5 A9 9C 8D C6 12
08A1:B5 A9 A8 8D 0C B2 A9 9C FF
08A9:8D 0D B2 A9 FD 8D FD BC 93
08B1:A9 9A 8D FE BC A9 3E 8D 75
08B9:72 A4 A9 9B 8D 73 A4 A9 48
08C1:4C 8D 00 AF A9 9B 8D 01 2E
08C9:AF A9 0E 8D E8 AE A9 9B A7
08D1:8D E9 AE A9 C9 8D D2 AF 6D
08D9:A9 9A 8D D3 AF A9 CF 8D A5
08E1:F2 AE A9 9A 8D F3 AE A9 39
08E9:24 8D E4 AE A9 44 8D 2F 9F
08F1:A1 A9 CF 8D 30 A1 A9 0F 7A
08F9:8D 4E B5 8D 55 B1 A9 0A C2
0901:8D 0F B6 8D 89 B1 A9 6A 1E
0909:8D 66 A4 A9 EA 8D 10 B6 0F
0911:A9 60 8D 69 B1 A9 79 8D 0D
0919:E4 B3 A9 00 8D E5 B3 A0 CB
0921:00 B9 0E 08 99 00 03 C8 7F
0929:C0 0C D0 F5 A9 09 8D 20 C4
0931:D0 8D 21 D0 EE 86 02 4C 22
0939:9A E3 C9 80 D0 1E 48 A5 08
0941:0B 84 08 A0 0B D9 25 99 A8
0949:F0 0D 88 10 F8 A4 08 BD 51
0951:01 02 20 C2 9B B0 04 68 A4
0959:4C 90 99 68 4C C0 99 04 0C
0961:18 23 26 2A 2B 2C 2D 2E 42
0969:31 32 33 A9 36 85 01 38 A3
0971:24 18 A9 9E 85 FB A9 9D C7
0979:85 FD A9 A0 85 FC 85 FE 37
0981:90 06 A6 7A A0 04 84 0F 07
0989:BD 00 02 10 07 C9 FF F0 0C
0991:3D E8 D0 DD C9 20 F0 36 5B
0999:85 08 C9 22 F0 55 24 0F FF
09A1:70 2C C9 3F D0 04 A9 99 A7
09A9:D0 24 C9 30 90 04 C9 3C CD
09B1:90 1C 84 71 A0 00 84 0B D3
09B9:88 86 7A CA C8 E8 BD 00 13
09C1:02 38 F1 FB F0 F6 4C 00 DC
09C9:99 EA 05 0B A4 71 E8 C8 3A
09D1:99 FB 01 B9 FB 01 F0 37 68
09D9:38 E9 3A F0 04 C9 49 D0 83
09E1:02 85 0F 38 E9 55 D0 89 8B
09E9:85 08 BD 00 02 F0 DF C5 D1
09F1:08 F0 DB C8 99 FB 01 E8 F3
09F9:D0 F0 A6 7A E6 0B C8 B1 D3
0A01:FD 10 FB B1 FB D0 B7 EA 30
0A09:F0 0F BD 00 02 10 BD 99 76
0A11:FD 01 C6 7B A9 FF 85 7A C7
0A19:60 A5 FB C9 9E D0 EB A0 93
0A21:0E 84 FB A2 9F 86 FC 88 A0
0A29:84 FD C8 D0 01 CA 86 FE 64
0A31:A0 00 A6 7A 18 90 87 20 44
0A39:03 9A 4C AE A7 20 73 00 8E
0A41:D0 01 60 E9 80 90 11 C9 DA
0A49:23 B0 17 0A A8 B9 0D A0 85
0A51:48 B9 0C A0 48 4C 73 00 DD
0A59:4C A5 A9 C9 3A F0 DE 4C 6E
0A61:08 AF C9 4B D0 03 4C 12 90
0A69:A8 B0 03 4C 08 AF C9 54 0A
0A71:B0 F9 E9 4B 0A A8 B9 50 05
0A79:9F 48 B9 4F 9F 48 4C 73 C5
0A81:00 10 47 C9 FF F0 43 24 8D
0A89:0F 30 3F 38 E9 7F AA 84 C3
0A91:49 A0 FF E0 4D B0 16 CA A4
0A99:F0 08 C8 B9 9E A0 10 FA 6F
0AA1:30 F5 C8 B9 9E A0 30 1F F6
0AA9:20 D2 FF D0 F5 38 E9 4C 40
0AB1:AA CA F0 08 C8 B9 0E 9F 55
0AB9:10 FA 30 F5 C8 B9 0E 9F E2
0AC1:30 05 20 D2 FF D0 F5 4C DB
0AC9:EF A6 4C F3 A6 20 73 00 E4
0AD1:08 A2 00 86 0D C9 D4 90 C4
0AD9:26 C9 D8 B0 22 28 48 C9 A5
0AE1:D6 B0 06 20 73 00 20 C9 F5
0AE9:9A 68 38 E9 D4 0A A8 B9 E4
0AF1:5F 9F 85 55 B9 60 9F 85 B7
0AF9:56 20 54 00 4C 8D AD 28 E7
0B01:4C 8D AE 20 FA AE 4C F4 98
0B09:AE 20 79 00 C9 28 D0 03 41
0B11:4C 73 00 A2 21 D0 03 4C F2
0B19:74 A4 8A 30 FA E0 1F B0 31
0B21:03 4C 3A A4 8A 38 E9 1F 85
0B29:0A AA BD 47 9F 85 22 BD 30
0B31:48 9F 85 23 4C 47 A4 08 07
0B39:C9 24 F0 0B 28 B0 03 4C 62
0B41:0D BD C9 2D 4C 00 BD 28 5F
0B49:A9 00 20 3C BC 20 73 00 49
0B51:90 0A C9 47 B0 19 C9 41 9E
0B59:90 15 E9 07 29 0F A2 04 79
0B61:06 63 26 62 B0 0F CA D0 66
0B69:F7 05 63 85 63 90 DE A2 3F
0B71:90 38 4C 49 BC 4C 48 B2 56
0B79:A5 39 85 14 A5 3A 85 15 D8
0B81:20 13 A6 4C C9 A6 8D 8A 94
0B89:9B A0 00 D1 7A D0 03 4C 1C
0B91:73 00 B1 7A D0 02 A9 01 22
0B99:8D 94 9B A9 7D 85 5F A9 14
0BA1:9B 85 60 A9 60 8D 14 A7 96
0BA9:A0 01 A9 0D 20 F3 A6 A9 1E
0BB1:4C 8D 14 A7 4C 62 A4 D0 54
0BB9:0B 3F 45 58 50 45 43 54 C5
0BC1:4E 47 20 27 20 27 20 46 6B
0BC9:4F 55 4E 44 20 27 20 27 EF
0BD1:00 8D 0E 9D 4C 90 FF 20 AB
0BD9:9E AD A9 A7 20 FF AE A5 5E
0BE1:61 D0 10 B1 7A F0 0C C9 73
0BE9:CE F0 07 C9 8B F0 0A C8 1E
0BF1:D0 F1 C8 20 FB A8 4C 40 63
0BF9:A9 4C 3B A9 C9 2E D0 01 A3
0C01:60 4C 13 B1 4C 08 AF A5 61
0C09:45 8D 34 03 A5 7A 85 4B 4B
0C11:A5 7B 85 4C 20 73 00 90 AF
0C19:05 20 C2 9B 90 0A E0 09 45
0C21:B0 F2 E8 9D 34 03 D0 EC 81
0C29:E8 E0 0A B0 04 A9 00 F0 F1
0C31:F2 AD 35 03 85 46 20 79 04
0C39:00 C9 24 D0 04 C6 0D D0 7B
0C41:13 C9 25 D0 1B A5 10 D0 67
0C49:BB A9 80 85 0E 05 45 85 A6
0C51:45 8D 34 03 A9 80 05 46 C5
0C59:85 46 8D 35 03 20 73 00 4A
0C61:05 10 49 5B D0 03 4C D1 DB
0C69:B1 20 79 00 C9 28 D0 13 35
0C71:68 48 C9 2A D0 0D A5 4B FC
0C79:85 7A A5 4C 85 7B 68 68 BF
0C81:4C F4 B3 A0 00 84 10 A5 55
0C89:2D A6 2E 86 60 85 5F E4 CC
0C91:30 90 04 C5 2F B0 1A A0 D3
0C99:00 B9 34 03 51 5F D0 08 88
0CA1:C8 C0 0A 90 F4 4C 85 B1 2E
0CA9:A5 5F 69 0F 90 DF E8 D0 31
0CB1:DA 68 48 C9 2A D0 03 4C DD
0CB9:23 B1 AD 36 03 D0 03 4C 96
0CC1:28 B1 A5 2F A4 30 20 47 6F
0CC9:B1 A0 09 B9 34 03 91 5F CF
0CD1:88 10 F8 A0 09 4C 74 B1 6F
0CD9:10 05 A0 0A 4C C7 B5 4C 29
0CE1:F6 B5 A9 5D 4C FF AE 20 CD
0CE9:73 00 20 FA AE 20 9E B7 5A
0CF1:8A 48 20 00 E2 8A 85 5F 11
0CF9:20 F7 AE 68 20 7D B4 A8 85
0D01:F0 0A 88 A5 5F 91 62 88 10
0D09:C0 FF D0 F9 68 68 4C CA 85
0D11:B4 20 79 00 D0 03 4C 1D 05
0D19:A8 20 6B A9 20 13 A6 B0 E2
0D21:03 4C E3 A8 A5 5F A4 60 2B
0D29:E9 01 4C 24 A8 20 9E B7 FE
0D31:E0 19 B0 09 8A 48 20 00 5E
0D39:E2 E0 28 90 03 4C 48 B2 97
0D41:68 85 D6 86 D3 4C 10 E5 0A
0D49:00 00 00 00 00 00 00 00 63
0D51:00 00 00 00 00 00 00 00 6B
0D59:00 00 00 00 00 00 00 00 73
0D61:00 00 00 00 00 00 00 00 7B
0D69:00 00 00 00 00 00 00 00 83
0D71:00 00 00 00 00 00 00 00 8B
0D79:00 00 00 00 00 00 00 00 93
0D81:00 00 00 00 00 84 FF AC 5A
0D89:0E 9D C0 3C 90 03 4C 0B 22
0D91:B3 A2 04 B5 FB 99 0F 9D 0C
0D99:C8 CA 10 F7 8C 0E 9D 60 84
0DA1:29 02 09 20 AA 4C 37 A4 8D
0DA9:AC 0E 9D F0 F3 48 A2 00 66
0DB1:88 B9 0F 9D 95 FB E8 E0 89
0DB9:05 D0 F5 8C 0E 9D 68 C5 8F
0DC1:FF D0 01 60 AA A5 FF 8D AF
0DC9:8A 9B 8A 4C 5E 9B A0 D1 9A
0DD1:A2 01 B5 7A 95 FB B5 39 1D
0DD9:95 FD CA 10 F5 4C 4B 9D AD
0DE1:A9 D1 20 6E 9D 20 9E AD 88
0DE9:A0 01 A5 61 F0 01 60 A2 4E
0DF1:01 B5 FB 95 7A B5 FD 95 0F
0DF9:39 CA 10 F5 88 D0 03 4C 9E
0E01:94 9D 88 F0 4D EA EA A0 7B
```

```
0E09:D3 20 96 9D 20 9E AD A9 44
0E11:A5 20 FF AE A5 7A A6 7B D2
0E19:86 FC 85 FB E4 2E 90 04 2D
0E21:C5 2D B0 33 A0 00 B1 FB 19
0E29:F0 0E C9 D3 F0 19 A9 01 F7
0E31:18 65 FB 90 E5 E8 D0 E0 90
0E39:A0 03 B1 FB 85 FD C8 B1 C3
0E41:FC 85 FE A9 05 D0 E9 E6 DD
0E49:FB D0 02 E6 FC A0 02 4C 01
0E51:B0 9D A9 D3 4C 6E 9D A2 99
0E59:1F 4C 37 A4 EA A9 D3 20 0F
0E61:6E 9D A0 03 4C B5 9D 20 F4
0E69:A1 B7 8A F0 04 E0 03 90 DE
0E71:03 4C 48 B2 29 01 AA BD B6
0E79:00 DC 60 20 2D 9E 29 0F 20
0E81:49 0F 4C 3C BC 20 2D 9E B2
0E89:29 10 49 10 4C 77 B0 A2 AC
0E91:02 B5 16 48 CA 10 FA 20 10
0E99:73 00 20 FA AE 20 9E AD 04
0EA1:20 8F AD 20 FD AE 20 0C 60
0EA9:BC 20 9E AD 20 8F AD 20 95
0EB1:F7 AE A0 02 A2 02 B1 64 8E
0EB9:95 5A B1 6C 95 5D 88 CA 32
0EC1:10 F4 E8 C8 A5 5D C5 5A 55
0EC9:90 1D B1 5B D1 5E D0 07 12
0ED1:C8 C4 5A D0 F5 F0 0F A0 0E
0ED9:00 E6 5E D0 02 E6 5F E8 DB
0EE1:E4 5D D0 E6 A2 FF E8 8A C1
0EE9:A8 A2 00 68 95 16 E8 E0 41
0EF1:03 D0 F8 4C A2 B3 57 48 82
0EF9:49 4C 45 20 57 49 54 48 49
0F01:4F 55 54 20 57 45 4E C4 D9
0F09:55 4E 54 49 4C 20 57 49 5F
0F11:54 48 4F 55 54 20 52 45 B7
0F19:50 45 41 D4 4F 50 45 52 BE
0F21:41 4E 44 20 4D 49 53 53 87
0F29:49 4E 47 20 4F 52 20 49 B7
0F31:4E 56 41 4C 49 C4 57 45 4A
0F39:4E 44 20 57 49 54 48 4F 84
0F41:55 54 20 57 48 49 4C C5 5E
0F49:48 4F 4D C5 43 4C D3 45 9D
0F51:4C 53 C5 4C 4F 43 41 54 46
0F59:C5 52 45 50 45 41 D4 55 CA
0F61:4E 54 49 CC 57 48 49 4C 6C
0F69:C5 57 45 4E C4 4A 4F D9 95
0F71:46 49 52 C5 53 54 52 49 85
0F79:4E 47 A4 49 4E 53 54 D2 F4
0F81:00 BC 9E CE 9E E2 9E FC 4A
0F89:9E 65 E5 43 E5 3A A9 F2 9F
0F91:9C 93 9D A5 9D CC 9D 22 6E
0F99:9E 41 9E 4B 9E AD 9C 55 1A
0FA1:9E 00 00 00 00 00 00 00 0F
```

128 Super Accelerator

Article on page 53.

Program 1: Super Accelerator

```
MH 10 FOR I=4864 TO 4999:READ
      {SPACE}D:POKE I,D:CK=CK+
      D:NEXT I
KE 20 IF CK<>13273 THEN PRINT
      {SPACE}"ERROR IN DATA ST
      ATEMENTS":END
DD 30 SYS 4864:PRINT"SUPER ACC
      ELERATOR ACTIVATED":END
XC 100 DATA 32,20,19,169,14,14
       1,0,10
EG 110 DATA 169,19,141,1,10,96
       ,32,20
DF 120 DATA 19,76,3,64,120,169
       ,33,141
RA 130 DATA 20,3,169,19,141,21
       ,3,88
GB 140 DATA 96,173,135,19,201,
       1,240,41
ES 150 DATA 201,2,240,45,216,3
       2,36,192
BH 160 DATA 144,18,32,248,245,
       32,208,238
HH 170 DATA 173,13,220,173,4,1
       0,74,144
SF 180 DATA 3,32,6,64,169,47,1
       41,18
AB 190 DATA 208,169,1,141,135,
       19,76,51
KG 200 DATA 255,32,196,119,169
       ,250,76,97
MK 210 DATA 19,32,179,119,169,
       255,76,97
CB 220 DATA 19,141,18,208,238,
       135,19,173
FJ 230 DATA 25,208,9,254,141,2
       5,208,76
HC 240 DATA 51,255,169,101,141
       ,20,3,169
PG 250 DATA 250,141,21,3,169,3
       ,141,0
AX 260 DATA 10,169,64,141,1,10
       ,96,0
```

Program 2: Super Accelerator Demo

```
HK 10 REM BE SURE YOU'RE IN 40
      COLUMN MODE
SS 20 SLOW:SYS4978:PRINT"{CLR}
      NORMAL SPEED":SLEEP1:GOS
      UB50:N1=SE
JX 30 SYS4864:PRINT"{3 DOWN}WI
      TH ACCELERATOR":SLEEP1:G
      OSUB50:N2=SE
MJ 40 PRINT"{3 DOWN}AN INCREAS
      E OF"INT((1-(N2/N1))*100
      )"{LEFT}%":END
HP 50 TT=TI:GRAPHIC1,1:FORI=0T
      O319STEP25:CIRCLE1,I,100
      ,50,50:NEXTI:SE=(TI-TT)/
      60
HJ 60 GRAPHIC0:PRINT"{DOWN}TIM
      E ="SE"SECONDS.":RETURN
```

Space Worms

See instructions in article on page 24 before typing in.

```
0801:0E 08 00 00 9E 32 30 36 6E
0809:34 20 20 20 00 00 00 A9 EA
0811:0B 8D 11 D0 EA EA EA 78 8A
0819:A9 34 85 01 A0 C4 B9 3C 93
0821:08 99 F8 00 E0 83 B0 06 37
0829:B9 E7 08 99 33 03 88 D0 32
0831:ED A9 D1 85 2D A9 60 85 8B
0839:2E 4C 00 01 16 E8 04 D0 B0
0841:78 12 1C B9 58 09 99 E8 34
0849:07 C8 D0 F7 EE 02 01 EE 19
0851:05 01 C6 F9 D0 ED A2 03 23
0859:20 34 03 F0 33 C9 07 D0 95
0861:16 A2 01 20 34 03 D0 0A A0
0869:A2 04 20 34 03 18 69 07 65
0871:10 05 A2 0E 20 34 03 85 5D
0879:A8 A5 A7 85 A9 A5 FE 85 FB
0881:F7 A5 FF 85 F8 20 6C 03 73
0889:A5 F8 85 FF A5 F7 85 FE 72
0891:E8 20 34 03 D0 19 A0 02 03
0899:D0 1D 85 A6 18 A5 FC 65 2B
08A1:A6 85 F7 A5 FD 65 A7 85 1A
08A9:F8 20 6C 03 4C 13 01 E8 95
08B1:20 34 03 D0 0B A0 03 84 B1
08B9:A8 A2 08 20 34 03 D0 DA F3
08C1:E8 20 34 03 D0 0A E8 20 A5
08C9:34 03 18 69 04 A8 D0 E7 9A
08D1:E8 20 34 03 D0 0A A2 02 0B
08D9:20 34 03 18 69 06 D0 ED DB
08E1:A2 08 20 34 03 D0 E6 A9 5F
08E9:00 85 A7 A4 FB F0 0C 06 5C
08F1:FA 2A 26 A7 C6 FB CA D0 D5
08F9:F2 A8 60 48 B1 FE 85 FA CD
0901:A9 08 85 FB 68 A4 FE D0 FE
0909:02 C6 FF C6 FE C0 E7 D0 D5
0911:DE A4 FF C0 07 D0 D8 A9 9E
0919:37 85 01 58 4C 00 70 A4 B5
0921:A8 F0 22 A5 F7 38 E5 A8 77
0929:B0 03 C6 F8 38 85 F7 A5 2A
0931:FC E5 A8 B0 02 C6 FD 85 08
0939:FC B1 F7 88 91 FC 98 D0 40
0941:F8 C4 A9 F0 0A B1 F7 C6 13
0949:FD C6 F8 C6 A9 10 EC E6 E5
0951:01 CE 00 04 C6 01 60 F8 CB
0959:E9 78 08 01 8F 10 16 3F B7
0961:0D 8F DF 92 07 0C D6 9E B7
0969:0B EE 11 D7 10 3E FF F9 CF
0971:5B 24 F8 FC 01 83 E0 20 21
0979:37 4B 0C 0F 01 B1 24 84 08
0981:00 00 00 00 00 00 00 00 93
0989:00 00 00 00 00 00 00 00 9B
0991:00 00 00 00 00 00 00 00 A3
0999:00 00 00 00 00 00 00 00 AB
09A1:00 00 00 00 00 2C 01 FE 65
09A9:CF E3 C1 7C 63 84 75 F0 A5
09B1:80 90 01 EF FA FF 91 9F E1
09B9:88 08 CF 0F C6 A3 10 07 E8
09C1:8F 92 81 61 08 01 C7 A9 04
09C9:1F EF F9 59 24 F8 14 7A E3
09D1:3C 78 44 0C 8F C2 43 48 BF
09D9:E4 09 01 F1 A3 F0 04 29 F1
09E1:DA 28 F8 FC 4D 01 39 BC F7
09E9:7E 40 03 C7 88 7E 10 3A C0
09F1:3F 21 0F A1 85 01 93 17 56
09F9:4F 03 39 80 03 93 DE 1F E6
0A01:29 F9 39 79 08 ED C6 E1 4E
0A09:51 03 01 80 07 09 F8 FE FB
0A11:A8 3C 84 6C F0 F0 34 3C CF
0A19:04 C4 0F CB A3 38 C0 F0 6F
0A21:40 06 00 C0 FC 7E 58 10 85
0A29:3E 12 10 04 00 40 BF 13 B6
0A31:94 C7 04 C5 00 00 00 00 5E
0A39:00 00 00 00 87 FF 33 1F 0F
0A41:43 E1 31 C6 70 60 3C F8 78
0A49:02 08 60 0C 38 67 CF F8 25
0A51:68 01 21 61 CC 38 33 8C 4E
0A59:38 1F 1E 7D A0 38 85 0E EB
0A61:04 1F 3C 02 42 19 40 7A 58
0A69:15 C1 3E 1D E3 72 F7 21 0C
0A71:11 DD B2 C9 20 05 C7 E0 FD
0A79:4A 20 40 04 00 44 08 C1 E5
0A81:C6 18 E3 EF 80 FF BF 7E 7C
0A89:03 F2 15 08 01 07 8C 12 4E
0A91:BF 18 06 B0 1F 85 07 C7 3C
0A99:9F 0C E3 AF 80 10 73 0E 31
0AA1:A0 02 86 80 71 9C 12 10 91
0AA9:34 F8 0C E0 70 07 C0 70 37
0AB1:C0 29 C0 66 FD F0 15 C1 8E
0AB9:E0 7C FC A0 C0 60 66 FC 58
0AC1:00 FE 29 7F BF BC 2E 18 18
0AC9:11 38 B2 38 31 18 70 3F 58
0AD1:1F C0 08 19 22 18 C0 30 5B
0AD9:98 E0 31 98 70 7F BC F8 16
0AE1:80 5C 02 87 80 98 11 F0 7F
0AE9:10 01 21 60 20 07 3A 70 72
0AF1:72 FC E0 06 FF 60 0F 7E 19
0AF9:F0 FE E9 0C FF 30 1E 3C 7D
0B01:78 1D DB F9 F0 9F 96 07 EF
0B09:9F C3 18 7E 18 1D 99 B8 EB
0B11:3D E7 87 0B 81 88 A5 BC 97
0B19:3D 99 BC 80 86 C3 6F BD B3
0B21:E7 27 E4 01 02 1A 82 42 61
0B29:38 08 04 0F 52 F5 C3 37 F7
0B31:66 EC 3B BD DC 1C C3 38 10
0B39:1F 3C E4 3F C3 F2 43 F2 E1
0B41:A0 00 07 81 0F 5A A0 7E 42
0B49:33 66 CC 3C 3C 3C D8 A1 16
0B51:E2 07 E3 E1 C7 01 FF 80 F7
0B59:07 FF E0 0F FF F0 1F FF 02
0B61:F8 1F FF F8 3F 81 FC 30 75
0B69:66 0C 0F 4A F0 0F 42 F0 75
0B71:31 66 8C 3E 00 7C 21 C0 24
0B79:FF 43 3C 7E 17 01 F0 00 6E
0B81:07 3E BE 7F F0 FC 23 7F BB
0B89:22 3C 9F 1F BD F9 71 70 CE
0B91:00 78 CD 0E 1E 3C 3F 1F DF
0B99:C3 F8 08 FE 63 F1 5A F9 52
0BA1:59 99 F8 FC DB C8 8F C3 9E
0BA9:38 C7 1E 00 1C 0F 3C 3E 65
0BB1:0F C3 FA 0E 3C 78 09 FF 56
```

```
0BB9:90 06 3A 05 3C 68 4B 2D 78
0BC1:DB 40 09 B4 2D 18 B4 2E A3
0BC9:3C 74 17 18 6E 16 00 68 B3
0BD1:09 C3 90 07 E7 2F FC A7 7D
0BD9:21 0D 3F 0B 0F 9E 88 47 A7
0BE1:4E 0E 01 21 C3 60 8A 72 FB
0BE9:08 49 3C 7E 75 F0 44 3C F9
0BF1:72 18 4E 42 40 08 81 18 72
0BF9:18 86 80 10 92 78 FC 7E BD
0C01:75 90 A0 06 5E 44 8A 18 9D
0C09:11 1D E2 42 44 88 05 51 11
0C11:C0 10 10 1B FF 81 FF 7F C6
0C19:C3 FE 7F FF FE 3F FF FC B4
0C21:CA D5 C4 8C 07 FF E0 01 70
0C29:FF 80 7E 16 3F 11 7E 9F 6D
0C31:1F 41 01 54 1F FB 24 24 E3
0C39:78 E8 8C A0 98 83 1F A1 16
0C41:FE 26 3F 0D 41 00 82 BF E9
0C49:5F 87 C7 8F D7 F9 BD 91 98
0C51:1F F7 B9 FD F0 20 84 06 25
0C59:8F F8 78 31 36 D8 F2 53 E7
0C61:F1 E0 11 3F 0B 3C 1F 5E A6
0C69:F7 80 07 AD E0 D5 0F EB C1
0C71:B0 70 05 80 20 0A FE A8 76
0C79:48 F8 1F 80 16 40 70 40 B2
0C81:04 B0 0F FF F0 1D FF B8 5E
0C89:1C 3C 38 32 00 4C 22 00 5E
0C91:44 12 00 48 B0 FF 2C 3C EE
0C99:78 74 5C 88 08 B1 20 04 6A
0CA1:84 80 5F FF FA B3 13 FF D4
0CA9:C8 0C 7E 30 D1 42 0F 8F 41
0CB1:9F 85 07 4F 63 44 74 08 ED
0CB9:24 1C 0B 42 40 08 2F FF F0
0CC1:F4 38 01 61 83 04 7E 20 E1
0CC9:03 81 C0 5B 68 C7 0F E3 F5
0CD1:26 C7 0B A4 88 11 A1 81 E7
0CD9:63 61 17 FF E8 9F 80 10 B5
0CE1:0B FF D0 70 02 05 FF A0 65
0CE9:02 7E 40 01 81 80 00 7E 47
0CF1:92 23 E4 FF 53 F2 FF 7F 9E
0CF9:F8 FF 3F FC FF 1F FE FF C0
0D01:0F FF FF 87 FF FF C3 F5 98
0D09:F5 00 00 00 00 00 00 00 1E
0D11:00 00 00 00 00 00 00 00 2B
0D19:00 00 00 00 00 00 00 00 33
0D21:00 00 00 00 00 00 00 00 3B
0D29:00 00 00 00 00 00 00 00 43
0D31:00 00 00 00 00 00 00 00 4B
0D39:00 00 00 00 00 00 00 00 53
0D41:00 00 00 00 00 00 00 00 5B
0D49:00 00 00 00 00 00 00 00 63
0D51:00 00 00 00 00 99 80 FF D2
0D59:1F 7B 7C 60 C9 57 C3 7E 29
0D61:60 78 EF A6 E2 C1 A0 7E 10
0D69:18 18 18 F3 82 E2 11 60 F9
0D71:60 7E 00 00 00 00 00 00 5B
0D79:00 00 00 00 00 00 00 00 93
0D81:00 00 00 00 00 3C 66 66 BF
0D89:66 3C 60 03 F8 8F 89 47 82
0D91:7C 80 70 C0 81 3E 60 FA E4
0D99:C7 41 01 F1 80 18 E6 90 E9
0DA1:95 3D 72 CD 1E 3F D0 01 91
0DA9:2F 18 38 2C 18 38 C8 60 BE
0DB1:7E 75 20 22 3C E4 A1 66 AD
0DB9:66 55 06 21 0F 8C 03 06 E5
0DC1:7C 7A 60 7C 60 3D 7E 06 87
0DC9:0C 18 34 2D 18 01 50 00 AE
0DD1:07 3C 66 3E 06 3C 5C 03 0C
0DD9:46 18 80 F8 FF 00 00 00 BC
0DE1:00 00 00 00 00 00 00 00 FB
0DE9:00 00 00 00 00 00 00 00 04
0DF1:00 00 00 00 00 00 00 00 0C
0DF9:00 00 00 00 00 00 00 00 14
0E01:00 00 00 00 00 00 00 00 1D
0E09:00 00 00 00 00 00 00 00 25
0E11:00 00 00 00 00 00 00 00 2D
0E19:00 00 00 00 00 00 00 00 35
0E21:00 00 00 00 00 00 00 00 3D
0E29:00 00 00 00 00 00 00 00 45
0E31:00 00 00 00 00 00 00 00 4D
0E39:00 00 00 00 00 00 00 00 55
0E41:00 00 7F 19 F0 FF CE 01 05
0E49:1F 03 02 3C 06 04 78 0C F6
0E51:08 F0 18 E0 10 31 C0 20 A5
0E59:63 80 40 C7 00 80 8F FF EC
0E61:FF C3 FF FF E1 FF FF F0 6E
0E69:FF 7F F8 FF 3F FC FF 1F 91
0E71:FE FF 0F FF FF 87 FF FF 0D
0E79:C3 FF FF E1 FF FF F0 FF 77
0E81:7F F8 FF 3F FC FF 1F FE B4
0E89:FF 0F FF FF 87 FF FF C3 69
0E91:FF FF E1 FF FF F0 FF 7F 2D
0E99:F8 FF 3F FC FF 1F FE FF 64
0EA1:0F FF FF 87 FF FF C3 FF 45
0EA9:FF F1 0E FF B8 C3 7B EC BC
0EB1:F0 3C 3A 3C 1E 0E 0F 8F 37
0EB9:03 1D 03 8C 00 00 00 8C 54
0EC1:8C 74 83 36 8F 90 91 92 89
0EC9:93 94 95 96 97 E2 68 A0 AA
0ED1:A2 A5 A8 AB AE B1 B4 B7 D5
0ED9:BA BC 4C 6E C7 C5 C6 C7 9D
0EE1:C8 C9 CA CB CC CD E2 71 BF
0EE9:00 D0 27 95 40 CD CC CB 17
0EF1:CA C9 C8 C7 C6 C5 49 FC 58
0EF9:91 BC BA B7 B4 B1 AE AB 56
0F01:A8 A5 A2 A0 C9 3B 97 96 3C
0F09:95 94 93 92 91 90 8F 59 F9
0F11:1C 8D FF 72 72 73 74 75 87
0F19:76 78 7A 7C 7E 80 82 84 27
0F21:86 87 88 89 13 FB 8B 8C 3A
0F29:8D 8E 90 92 94 96 98 9A B7
0F31:9C 9E 9F A0 A1 21 F4 32 F0
0F39:A3 A4 A5 A6 A8 AA AC AE 69
0F41:B0 B2 B4 B6 B7 B8 B9 E8 63
0F49:43 BB BC BD BE C0 C2 C4 AE
0F51:C6 C8 CA CC CE CF D0 D1 54
0F59:D0 43 D3 D4 D5 D6 D8 DA 0F
0F61:DC DE E0 E2 E4 E6 E7 E8 6B
0F69:E9 EA EA E9 E8 E7 E6 E4 CC
0F71:E2 E0 DE DC DA D8 D6 D5 A0
0F79:D4 D3 D2 D2 D1 D0 CF CE BE
0F81:CC CA C8 C6 C4 C2 C0 BE AF
0F89:BD BC BB BA BA B9 B8 B7 BE
0F91:B6 B4 B2 B0 AE AC AA A8 BF
0F99:A6 A5 A4 A3 A2 A2 A1 A0 C6
0FA1:9F 9E 9C 9A 98 96 94 92 4F
0FA9:90 8E 8D 8C 8B 8A 8A 89 53
0FB1:88 87 86 84 82 80 7E 7C 9E
0FB9:7A 78 76 75 74 73 90 01 EC
0FC1:6F 5D 5E 5F 61 63 65 67 7B
0FC9:69 6B 6D 6F 71 73 75 77 D7
0FD1:79 7B 7D 7F 81 83 85 87 DF
0FD9:89 8B 8D 8F 91 93 95 97 E7
0FE1:99 9B 9D 9F A1 A3 A5 A7 EF
0FE9:A9 AB AD AF B1 B3 B5 B7 F7
0FF1:B9 BB BD BF C1 C3 C5 C7 FF
0FF9:C9 CB CD CF D1 D3 D5 D7 08
1001:D9 DB DD DF E1 E3 E5 E7 11
1009:E9 EB ED EF F1 F3 F5 F7 19
1011:F9 FB 2A 0A F8 4F ED FB 10
1019:F9 F7 F5 F3 F1 EF ED EB 49
1021:E9 E7 E5 E3 E1 DF DD DB 51
1029:D9 D7 D5 D3 D1 CF CD CB 59
1031:C9 C7 C5 C3 C1 BF BD BB 61
1039:B9 B7 B5 B3 B1 AF AD AB 69
1041:A9 A7 A5 A3 A1 9F 9D 9B 71
1049:99 97 95 93 91 8F 8D 8B 79
1051:89 87 85 83 81 7F 7D 7B 81
1059:79 77 75 73 71 6F 6D 6B 89
1061:69 67 65 63 61 9F 80 3F BC
1069:FF 5D 62 66 6A 6E 72 76 FB
1071:7A 7E 82 85 88 8B 8E 91 38
1079:94 97 9A 9D A0 A2 A4 A6 76
1081:A8 AA AC AE B0 B2 B4 B6 91
1089:B8 BA BC BE C0 C2 C4 C6 99
1091:C8 CA CC CE D0 D2 D4 D6 A1
1099:D8 DA DC DE E0 E2 E4 E6 A9
10A1:E8 EA EC EE F0 F1 F2 F3 A6
10A9:F4 F5 F6 F7 F8 F9 FA FB C1
10B1:FC FC A7 04 BC 81 08 FE BF
10B9:FE FD FD FD FC FC FB FA 47
10C1:F9 F8 F7 F6 F5 F4 F3 F2 E9
10C9:F1 F0 EE EC EA E8 E6 E4 79
10D1:E2 E0 DE DC DA D8 D6 D4 02
10D9:D2 D0 CE CC CA C8 C6 C4 0A
10E1:C2 C0 BE C0 02 3C CD C3 D7
10E9:9D 9A 97 94 91 8E 8B 88 22
10F1:85 82 7E 7A 76 72 6E 6A B1
10F9:66 62 FF FE FA F6 F2 5F CE
1101:00 8F CD F0 C5 C2 BF D3 5C
1109:B2 B0 AE AC AA EE A6 2F DE
1111:92 90 8E 8C 8A 88 86 84 43
1119:82 80 7E 7C 7A 78 76 74 4B
1121:72 70 6E 6C 6B 6A 69 68 6D
1129:67 66 65 64 63 62 61 60 53
1131:3C 08 F0 0B 60 20 9E 85 88
1139:B3 68 06 66 61 62 63 64 36
1141:65 66 67 68 69 6A 6A 6B 6C 5B
1149:6E 70 72 74 76 78 7A 7C 5B
1151:7E 80 82 84 86 88 8A 8C 63
1159:8E 90 92 1F C0 CB 2C AA 63
1161:AC AE B0 B2 7C 83 BF C2 FA
1169:C5 7A 43 0C F2 F6 FA FF 9F
1171:6E 72 76 7A 7E 82 85 88 6F
1179:8B 8E 91 8F 8E CE 88 CF C0
1181:A9 AA AB A7 04 45 C2 87 55
1189:71 23 64 B1 B2 B3 6C 5D 6F
1191:07 BD CB CE D1 D4 D7 DA 79
1199:DE E2 E6 EA EE EA E6 E2 43
11A1:DE DA D7 D4 D1 CE CB EE 82
11A9:F5 0C FF B3 B2 B1 B0 B0 73
11B1:AF AF AF 3C 9C 95 AD AD 95
11B9:AD AC AC AB AA A9 C3 F1 A3
11C1:98 96 94 91 8E 8B 88 85 BA
11C9:82 7E 7A 76 72 FF 5D 5D 2F
11D1:5D 75 75 2F 5F 60 62 65 48
11D9:69 6D 71 75 79 7D 81 85 DB
11E1:89 8D 91 95 99 9D A1 A5 E3
11E9:A9 AD B1 B5 B9 BD C1 C5 EB
11F1:C9 CD D1 D5 D9 DD E1 E5 F3
11F9:E9 ED F1 F5 F8 FA FB 2B 01
1201:C0 13 FD FD FD FC FC FB C3
1209:FA F8 F5 F1 ED E9 E5 E1 8B
1211:DD D9 D5 D1 CD C9 C5 C1 55
1219:BD B9 B5 B1 AD A9 A5 A1 5D
1221:9D 99 95 91 8D 89 85 81 65
1229:7D 79 75 71 6D 69 65 62 6E
1231:60 5F 5E 5E FF 98 01 9E 12
1239:A0 11 86 86 86 88 8A 8C 23
1241:8E 90 92 94 96 98 A0 3C 01
1249:4E E1 9C 9E A0 A2 A4 A6 0A
1251:A8 AA AC C5 97 14 B0 B2 87
1259:B4 B6 B8 BA BC BE C0 5E 09
1261:BC 44 E1 C4 C6 C8 CA CC 39
1269:CE D0 D2 D4 C5 09 1A 01 58
1271:D6 D6 D6 D4 D2 D0 CE CC 23
1279:CA C8 C6 C4 CA 09 1A 01 0A
1281:C2 C2 C2 C0 BE BC BA B8 33
1289:B6 B4 B2 B0 CA 09 1A 01 47
1291:AE AE AE AC AA A8 A6 A4 43
1299:A2 C4 85 19 03 8C 1A 21 22
12A1:03 B9 3B A8 20 6E 70 72 B5
12A9:74 76 79 7C 7F 82 5E 9C FB
12B1:19 C4 93 94 95 96 97 98 1E
12B9:DA 0B 60 20 02 9B 9B 9A 6C
12C1:9A 9A 99 99 98 97 96 95 8C
12C9:94 93 98 E7 E1 85 82 7F 58
12D1:7C 79 76 74 72 70 6E E3 BE
12D9:87 0D 64 64 64 BF 3F A1 1A
12E1:67 68 69 6A 6B 6C 6D 6E FD
12E9:6F 70 71 72 73 74 75 76 06
12F1:77 78 79 7A 7B 7C 7D 7E 0E
12F9:7F 80 81 82 84 86 88 8A 30
1301:8C 8E 90 92 94 96 98 9A 17
1309:9C 9E 47 05 F8 32 A6 A9 E5
1311:AC AF B2 B5 B8 BB BE C2 20
1319:C6 CA CE D2 D6 DA DF DA 19
1321:D6 D2 CE CA C6 C2 BE BB 68
1329:B8 B5 B2 AF AC A9 A6 21 E4
1331:C0 9B 9E 9C 9A 98 96 94 35
1339:92 90 8E 8C 8A 88 86 84 6F
1341:82 81 80 7F 7E 7D 7C 7B 6F
1349:7A 79 78 77 76 75 74 73 77
1351:72 71 70 6F 6E 6D 6C 6B 7F
1359:6A 69 68 67 66 66 65 65 8F
1361:65 FF 64 69 6D 71 75 79 F2
1369:7D 81 85 88 8B 8E 91 94 36
1371:97 9A 9D A0 A3 A5 A7 A9 74
1379:AB AD 42 02 9E B3 B5 B7 30
1381:B9 BB BD BF C1 C2 C3 C4 8C
1389:C5 C6 C7 C8 C9 CA CB CC A7
1391:CD CE CF D0 D1 D2 D3 D4 AF
1399:D5 D6 D7 D8 D9 DA DB DC B7
13A1:DF 08 F0 0B 60 20 02 DF EF
13A9:DF DE DE DE DD DD DC DB 3D
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13B1:DA D9 D8 D7 D6 D5 D4 D3 DF
13B9:D2 D1 D0 CF CE CD CC CB E7
13C1:CA C9 C8 C7 C6 C5 C4 C3 EF
13C9:C2 C1 BF BD BB 98 00 6F 45
13D1:B5 B3 B1 AF AD AB A9 A7 08
13D9:A5 A3 A0 9D 9A 97 94 91 97
13E1:8E 8B 88 85 81 7D 79 75 06
13E9:71 6D 69 6D 03 F8 34 92 1F
13F1:B0 B4 B8 DF 5C C3 83 E5 91
13F9:E5 E5 CE E2 40 8E E1 B8 4D
1401:B4 B0 87 1A F2 3C 3C 3C 7F
1409:3D 3D 3E 3F 41 44 48 4C D2
1411:50 54 58 5C 60 E9 B0 7C CF
1419:80 84 88 38 87 A4 A8 AC 04
1421:AF B1 B2 71 73 C1 0A CB 7D
1429:63 45 98 B6 B7 B9 18 28 CF
1431:CC D0 D4 D8 DC DF E1 E2 29
1439:87 13 E4 E4 E4 E3 E3 E2 36
1441:E1 DF 08 F7 C4 C4 C0 BC 4A
1449:B9 B7 B6 B5 B5 C3 E7 B3 AE
1451:B3 B2 B1 AF EC 29 9C 98 0F
1459:94 90 53 17 74 70 6C 68 72
1461:67 73 50 4C 48 44 41 3F FD
1469:3E 83 47 FF CB 00 23 50 6F
1471:50 52 54 56 58 5A 5C 5E 89
1479:60 62 00 B9 A9 68 6C 70 3E
1481:74 CE 44 7A 7C 7E 80 82 29
1489:84 86 88 8A 5D 9C 4D 90 D7
1491:94 98 9C E7 93 A2 A4 A6 53
1499:A8 AA AC AE B0 B2 2E 2E 1C
14A1:A3 B8 BC C0 C4 C8 CA CC 19
14A9:CE D0 D2 D4 D6 D8 DA 9F 84
14B1:0F 30 02 DC DC D8 CC 93 F2
14B9:21 20 02 C8 C8 C6 C4 C2 F4
14C1:C0 BE BC BA B8 B6 90 0F 0E
14C9:30 02 B4 B4 B0 AC A8 A4 9A
14D1:78 80 31 C9 9E 9C 9A 98 4E
14D9:96 94 92 90 8E E2 03 8C 60
14E1:00 8C 8C 88 84 80 7C 1E 84
14E9:60 04 78 78 76 74 72 70 B4
14F1:6E 6C 6A 68 66 20 1F 60 92
14F9:04 64 64 60 5C 58 54 FF BC
1501:00 27 68 04 3C 3C 3C 58 E5
1509:3D 3D 3D 3E 3F 41 43 45 77
1511:48 4B 4E 52 56 5A 5F 64 60
1519:69 6E 73 79 7F 85 8B 92 55
1521:99 A0 A7 AE B6 BE C6 CE 2D
1529:D6 DE 00 11 E0 09 1A 51 38
1531:0C 28 86 93 E3 81 DA D7 28
1539:D4 D0 CC C8 C3 BE B9 B4 69
1541:AF A9 A3 9D 97 90 89 82 90
1549:7B 74 6C 64 5C 54 4C 44 33
1551:FF 72 03 F8 00 A0 A0 42 0E
1559:12 43 A3 A4 A5 A7 A9 AB E6
1561:AD B0 B3 B6 B9 BD C1 C5 7E
1569:C9 CD D0 D3 D6 D9 DB DD F6
1571:DF E1 E2 E3 34 80 5F 00 01
1579:03 11 E6 E6 E5 E5 E5 E4 2C
1581:E4 E3 E2 E1 DF DD DB D9 99
1589:D6 D3 D0 CD C9 C5 C1 BD B1
1591:B9 B6 B3 B0 AD AB A9 A7 DE
1599:A5 A4 A3 A2 A2 A1 A1 A1 DE
15A1:FF E0 04 78 FF FF 87 FF 1B
15A9:FF C3 FF FF E1 FF FF F0 C4
15B1:FF 7F F8 FF 3F B2 B5 1F 2A
15B9:6C 6D 0F 9B 9B 87 C6 C6 60
15C1:00 00 00 00 00 00 00 00 EB
15C9:00 00 00 00 00 00 00 00 F3
15D1:00 00 00 00 00 00 00 00 FB
15D9:00 00 6B 00 BF A9 DC 4D 1D
15E1:7B A9 60 85 3E A9 00 85 B6
15E9:3C AD 12 D0 C9 DC D0 CE 1F
15F1:41 85 8D 81 1C 40 03 44 14
15F9:6D DB 60 38 3A 90 27 E9 AD
1601:08 24 D1 18 E9 28 47 B0 25
1609:1A 41 1F E9 00 C9 03 D0 13
1611:07 20 AD 1C 8E 03 A9 07 1B
1619:60 06 4C 51 60 F6 00 66 DA
1621:A0 02 54 3F A0 03 E0 18 87
1629:20 A0 01 88 7E 08 B1 3D EA
1631:09 80 F0 26 3F 20 8A 60 72
1639:E6 3C A5 3C C9 10 F0 0E DE
1641:A5 3D 79 0E 01 1E 3D 90 2B
1649:02 E6 3E 4C 13 60 C2 51 AD
1651:05 18 69 29 85 3F 90 0C 1C
1659:E6 40 0D F1 11 08 D0 04 18
1661:A9 04 85 40 20 B9 60 E0 A1
1669:01 F0 06 CF 1B A9 20 91 61
1671:3F 60 AD 1B D4 29 07 F0 07
1679:F9 A0 00 91 3D A4 3B 07 DD
1681:70 1C F7 90 5A 0E A5 40 8B
1689:C9 04 D0 09 A5 3F C9 28 2C
1691:B0 03 A2 01 60 8C 5E 04 31
1699:58 E2 F6 46 1E 01 28 E8 1C
16A1:02 82 06 C1 2C 00 07 01 BC
16A9:04 13 04 02 05 6E 05 03 2C
16B1:06 C8 98 3F 03 E2 D0 04 63
16B9:73 03 3D 05 ED 05 04 06 E9
16C1:65 F0 07 27 07 02 03 6A E0
16C9:04 03 01 DD 05 01 00 88 6B
16D1:06 01 01 D8 07 00 A2 00 6C
16D9:A9 01 58 17 D8 10 01 D9 7A
16E1:11 DA 9D 00 DB CA D0 F1 9E
16E9:4C 00 60 30 EE FF FF F0 B3
16F1:FF 7F F8 FF 3F FC FF 1F 2A
16F9:FE FF 0F FF FF 87 FF FF A5
1701:C3 FF FF E1 FF FF F0 FF 11
1709:7F F8 FF 3F FC FF 1F FE 4E
1711:FF 0F F6 F6 47 9D DD 43 01
1719:67 E7 D1 E1 F1 70 78 78 08
1721:18 E4 18 60 04 00 00 10 CD
1729:85 20 A1 21 10 06 60 86 48
1731:02 20 44 E5 D1 19 15 63 CF
1739:C9 17 11 1D 10 50 1C C9 C9
1741:1D 8D 18 D0 20 2B 70 4C 4C
1749:92 70 30 CE DB A9 82 8D E7
1751:F9 4C 00 31 27 11 91 8D D0
1759:FA 07 43 54 12 43 FF 8D 9F
1761:0E D4 80 2A 85 41 A9 50 53
1769:85 42 A9 66 85 43 A9 54 67
1771:85 44 A2 10 D2 79 60 A1 A7
1779:FA 58 85 B6 F0 A9 04 8D 1B
1781:5D 9C 83 1B B0 A2 27 BD C3
1789:F6 C3 61 06 C9 3A F0 02 CB
1791:E9 40 06 4F 04 92 24 ED 1B
1799:20 92 78 60 78 A9 7F 8D 88
17A1:0D DC A9 E5 DB 1A E2 BB E9
17A9:8D 14 60 04 70 8D 15 03 D6
17B1:A9 1B 8D 11 D0 C4 6D 12 C4
17B9:D0 58 4C 1D 61 68 A8 68 28
17C1:AA 68 40 AD 34 17 8D 19 74
17C9:D0 30 31 F0 AD 5E 87 03 9A
17D1:4C B7 77 A2 03 BD 01 FC 3B
17D9:9D 00 D0 CA 10 F7 8D BF D8
17E1:8D 0C AD 87 18 F0 0A A9 4A
17E9:00 8D 5C B0 80 8D F8 07 45
17F1:AD 5A 07 87 43 AD 00 DC 94
17F9:E1 05 10 D0 EB AC 42 2E 2E
1801:0F 3A 08 A9 10 18 ED 52 F1
1809:8D 40 12 04 4C 82 38 49 B8
1811:08 E8 24 63 98 84 46 28 C5
1819:24 8C 08 3E 83 30 02 F0 35
1821:03 20 9C 71 4C D3 08 B7 FE
1829:00 95 10 8E 0A 20 67 1D 66
1831:2A 70 C8 E0 E0 29 FE 68 CB
1839:71 08 01 CE A3 60 20 5F 6F
1841:D0 18 AD 0B FE 4E 28 60 28
1849:31 7A 80 09 04 EE 4C 01 C6
1851:64 30 68 C9 38 F0 D9 4C EE
1859:79 F8 A1 B9 F0 CF 27 CE 38
1861:60 1E 70 18 C9 E3 F0 BF 58
1869:A0 80 EE B1 4C 62 71 30 02
1871:40 01 60 A9 01 A6 A1 AD 3C
1879:60 42 61 EC 08 42 1C 08 EE
1881:32 EE 08 65 09 02 4F ED BA
1889:60 A2 02 39 13 BD 73 F0 CD
1891:18 42 25 0C 01 BD 59 80 F5
1899:12 41 29 0E 31 25 65 A6 B8
18A1:E3 71 84 1A 4C 28 D4 47 46
18A9:03 84 11 FE 62 04 BD 64 91
18B1:A8 B1 43 C1 F4 18 25 9D 17
18B9:6D 54 09 72 A8 8A 0A A3 25
18C1:08 98 9D 00 D0 CA 8A 4A E0
18C9:AA E8 E0 08 D0 A8 AD CE 79
18D1:1B F0 1C AD AC C9 19 B0 99
18D9:18 01 4D 1B 99 42 02 2C B7
18E1:85 A7 4C 59 72 E9 05 DE 02
18E9:44 4C 4E 72 EE B9 20 10 EE
18F1:C9 04 D0 1E 90 40 CF F0 1A
18F9:41 96 14 AD 42 C9 80 F0 F8
1901:B0 52 80 39 4C 81 72 A9 BA
1909:81 B0 4F EE 46 AE 40 16 84
1911:BD 75 68 FF 51 16 A2 00 B4
1919:8E 41 76 4C 87 72 8D 89 21
1921:A7 AD 4C 53 07 81 14 4D 05
1929:88 08 04 AD 5D 76 69 30 C4
1931:8D 26 04 8E 71 2E 18 9D 2F
1939:15 04 73 69 F7 AD 1E 86 35
1941:04 15 01 F0 0F AD D2 D0 8F
1949:0A 80 50 5A CD 83 8D F8 E0
1951:07 AD 48 04 4F 02 F0 2F 4F
1959:A9 FF 8D 62 76 8D 63 76 5F
1961:20 F7 3F 30 14 40 29 FD 7E
1969:8D 64 76 20 0A 73 CE 40 48
1971:DC 10 12 80 52 8E 49 49 09
1979:0F 0C F0 24 A8 0E C5 B4 54
1981:0F 48 0B 03 1C 30 60 FE 40
1989:94 BD 80 20 40 BA 08 49 CD
1991:9D 52 76 CA 10 EE 60 A2 42
1999:03 27 6E AD 66 0C E0 A1 86
19A1:0C F3 0D 20 0F 0D 03 78 A5
19A9:0A E8 3C 0B C8 43 C3 00 2E
19B1:1E 08 3A 0F 09 F2 C0 AD 70
19B9:31 F0 0B 20 05 06 A3 07 B2
19C1:D0 4C 75 80 26 04 D0 8D 96
19C9:05 4C 3C 41 AD 68 02 F0 31
19D1:0D EE CD 42 4C C9 28 90 8E
19D9:BD 8A 73 4C 13 76 A2 02 7A
19E1:20 10 73 E3 65 4B 06 0D 46
19E9:7C 03 F0 38 1C BD 98 7C 42
19F1:E0 4C 30 3C DE 10 CD 83 C7
19F9:84 79 60 78 88 8C 19 31 3A
1A01:98 C0 F5 4C E9 73 A9 29 CE
1A09:0F F0 F9 A2 07 9D 27 D0 38
1A11:CA E0 29 F9 2B 40 01 8D 91
1A19:29 D0 A9 01 A2 04 9D 10 CB
1A21:9F E8 E0 10 D0 F8 D4 47 D7
1A29:8D 4A 72 00 01 50 62 38 4B
1A31:14 88 83 08 EE 92 05 3A 88
1A39:D0 05 A9 30 8D DC 02 AD E0
1A41:4C F4 30 F0 29 C9 31 F0 B1
1A49:C2 57 37 02 C1 B4 41 81 A0
1A51:AC F8 5C 34 AD 4D BC 6A 6F
1A59:35 90 11 0C A4 C2 40 28 08
1A61:3C 3A A2 07 BD 9C A4 65 16
1A69:76 9D 6D 76 CA 10 F4 AD 83
1A71:1B D4 8D 80 F2 41 28 14 23
1A79:07 D0 03 4C 6E 74 8D 4E 39
1A81:C0 05 71 9C 83 C3 0E 41 D7
1A89:5D 8E 83 50 71 C0 21 C8 1F
1A91:08 71 50 78 08 AF 72 1C B7
1A99:51 8C 03 0E 41 4B 8E 83 B2
1AA1:C2 43 90 E9 E3 52 60 1C FD
1AA9:1A 82 68 1D 05 4C F2 74 1E
1AB1:A9 CD 85 41 A9 53 85 42 DA
1AB9:9C 9C 95 50 C3 CA 07 CD 40
1AC1:22 00 70 8D 4F 76 C9 00 D5
1AC9:75 66 30 0E 0A 0F 37 70 A4
1AD1:BB 10 07 54 E3 80 63 0D 03
1AD9:1C 43 C4 41 E1 03 E3 CB 48
1AE1:60 1C 55 8C 03 8E 6E 70 60
1AE9:35 10 07 85 05 8F 83 DE 42
1AF1:71 56 30 0E C9 06 D0 0B 6E
1AF9:A9 A3 6D 05 57 A3 4C 75 41
1B01:40 2C 00 85 43 A9 58 85 B1
1B09:44 20 7A C4 35 C1 8D 44 15
1B11:4C 00 F3 C5 A0 C0 82 91 E6
1B19:59 C0 01 22 AE 94 E4 4C 4C
1B21:9F 40 9D 97 8D FA D8 4C BA
1B29:51 67 46 D8 26 18 1B 4D 4D
1B31:63 D0 0F 43 36 E0 D0 F0 2B
1B39:78 01 06 68 C9 F8 4C FC FA
1B41:75 A2 07 8D CD 62 08 F0 8D
1B49:F8 8D 57 76 29 03 F0 F1 DA
1B51:C9 8C 73 11 C9 02 18 86 1C
1B59:9D 39 4C F7 75 A9 A0 9D E6
1B61:F8 07 CA E0 02 D0 D7 AD ED
1B69:1B D4 29 01 F0 08 B0 DD 7E
1B71:43 1C A9 01 8D F4 0A 4C 36
1B79:6D 78 AD 58 76 F0 22 EE 6A
1B81:88 0B AD 08 C9 04 D0 18 0D
1B89:A9 00 8D 59 76 AC 29 D0 65
1B91:A2 03 BD 27 D0 9D 26 D0 1E
1B99:E8 E0 08 D0 F5 8C 2E D0 99
1BA1:4C 2F 77 82 0F E0 FB 70 45
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1BA9:1E 18 22 43 94 01 03 03 1F
1BB1:0E 0E 59 18 11 01 10 F0 EC
1BB9:C0 01 07 0A 03 02 09 00 6C
1BC1:0B 0C 0F 01 E4 04 0B 62 22
1BC9:A4 F0 14 10 0C 08 84 00 9B
1BD1:23 1C 15 0E B1 14 00 1E 20
1BD9:18 12 0C 06 5A 6D C7 81 1C
1BE1:07 29 31 30 08 8C 00 30 B1
1BE9:30 30 83 C2 04 53 AE B9 65
1BF1:FF FF 80 07 3A 76 0F 0C 7E
1BF9:09 06 03 EC FF 01 0C 79 FA
1C01:45 88 4C 87 34 EC 53 43 3F
1C09:4F 52 45 85 10 03 8C 00 24
1C11:40 20 4C 49 56 45 53 3A 38
1C19:20 20 8A 8C A2 8C BA 8C CC
1C21:D2 8C A0 3E C0 08 00 00 04
1C29:00 AD C0 11 F0 75 C9 02 E8
1C31:F0 21 06 C9 06 D0 67 07 D0
1C39:D2 EE 11 AD F8 20 6E 8C 45
1C41:D0 58 A9 02 A5 10 5D EE 64
1C49:46 AD 40 10 C9 4B D0 46 7C
1C51:90 5B DA 00 5A 76 CE 9A E8
1C59:AD 5D 76 10 00 26 AC C9 4B
1C61:1B D4 29 01 F0 15 06 53 CC
1C69:09 98 11 A0 10 19 1E 9D 37
1C71:07 4C A4 77 AD 49 29 FE 30
1C79:8D 64 80 04 32 8D 60 46 B0
1C81:B9 8D 61 60 26 70 5C 76 4E
1C89:4C 27 80 C0 90 5E 76 20 D8
1C91:F8 77 4C C1 40 A5 CB C9 C3
1C99:40 D0 03 4C D7 77 20 18 40
1CA1:78 20 2B 70 D0 C9 F6 CD F3
1CA9:32 A9 40 85 CB 4C BB 70 3D
1CB1:EE 1E 2E AE 20 08 E0 08 84
1CB9:D0 05 A2 00 8E 5F 76 BD 8C
1CC1:94 76 8D 27 CE 05 28 44 25
1CC9:00 7A E1 4C A9 77 A2 10 22
1CD1:BD 1E 77 9D 00 D0 57 F2 1E
1CD9:0F A9 8D 8D 87 A9 8E 8D 1C
1CE1:F9 87 04 8F 92 A9 90 8D 5C
1CE9:E8 16 60 A2 36 BD BC 76 EA
1CF1:9D 3E 76 89 CF F7 20 87 16
1CF9:78 60 AD 70 C9 91 90 34 2D
1D01:EE 8A 0A AD 08 C9 05 D0 B3
1D09:2A 02 E6 EE 74 04 AD C4 78
1D11:C9 04 F0 1E C9 02 F0 0F 78
1D19:C9 03 F0 0B 44 B9 FE 82 51
1D21:28 E0 62 78 A2 05 DE E5 48
1D29:81 21 41 C1 60 80 03 4C 08
1D31:4F 78 CB 50 4C 31 EA A9 56
1D39:9A A2 07 9D F8 78 F1 10 C1
1D41:E0 02 D0 F8 54 80 9E 60 58
1D49:3D 13 F6 46 91 8D FA 07 E9
1D51:A2 04 A9 9D 9D FB 07 CA A2
1D59:10 FA C6 F9 88 1D 21 01 CE
1D61:8D 29 B0 03 03 8D 2A 3B D0
1D69:2B 90 03 0E 8D 2C D0 8D EA
1D71:2D 26 06 8D 2E D0 A9 FF 6D
1D79:8D F4 76 A9 00 8D F3 76 B5
1D81:60 80 00 00 00 00 00 00 0C
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Brusher

See instructions in article on page 29 before typing in.

Program 1: Brusher BASIC

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FH 10 REM COPYRIGHT 1989 COMPUTE! PUBLICATIONS, INC. - ALL RIGHTS RESERVED
BG 20 FAST:DIMC1(18),C2(18),NS(18),SP(18):GRAPHIC3,1
FP 30 COLOR0,1:COLOR4,1:GOSUB300:SLOW:POKE2827,2
BK 40 IFSC>BSTHENBS=SC
RD 50 LV=0:L=0:SD=0:SC=0:YC=0:YL=0:OS=0
HH 60 SD=SC:YC=YC+1+(YC=18)*18:COLOR1,C1(YC):COLOR2,C1(YC):COLOR3,C2(YC)
AA 70 GRAPHIC3,1:GOSUB390:GOSUB420
FM 80 FORU=0TO9:FORT=0TO8:BOX1,8+T*12,8+U*16,20+T*12,24+U*16:NEXTT,U
AK 90 LV=LV+1:OS=SC:L=L+1+(L=18):POKE2933,0:IFLV/4=INT(LV/4)THENYL=YL-1
CB 100 SOUND3,8000,3:SPRITE1,0,,10:MOVSPR1,152,128:SPRITE8,0,C2(YC):SLEEP2
MF 110 GOSUB450:POKE6067,SP(L):POKE2825,0:POKE2901,0:POKE8184,95
BH 120 POKE2903,96:POKE2904,0:POKE2902,0:POKE2915,0
MP 130 FORT=0TO7:POKE8184+T,95+T:NEXT:SLOW:B=0:SYS6016:ML=2-YL:GOSUB440
PD 140 GOSUB220:IFPEEK(2933)THEN280
GS 150 IFPEEK(2915)THENGOTO250
QA 160 IFPEEK(2949)THENPOKE53269,1:TI$="000000":CAN=1:POKE2949,0:SOUND1,40000,5
QG 170 IFTI$>"000001"AND CAN THENGOSUB450:CAN=0:SOUND2,9999,20
JP 180 IFPEEK(DEC("0B0A"))ANDB=0THENB=1:TI$="000000":SOUND1,400,10
MH 190 IFTI$>"000003"ANDB=1THENB=2:GOSUB450:SOUND3,2000,10
CP 200 IFCAN=0THENMS=MS+1:IFMS=10THENMS=0:IFSP(L)=2THENGOSUB480
HX 210 GOTO140
EJ 220 SC=SD+LV*(10*(PEEK(2912)+256*PEEK(2913)))
GH 230 IFSC=CSTHENSOUND1,300,1,1,300,300,3:RETURN
XP 240 SOUND1,1000,5:CS=SC:CHAR1,38-LEN(STR$(SC)),15,STR$(SC):RETURN
SC 250 SOUND1,10000,40,1,300,100,0:POKE53269,0:YL=YL+1:IFYL<3THEN100
MC 260 COLOR1,9:CHAR1,10,22,"{SPACE}GAME OVER ",1:COLOR1,3:PLAYM2$
BE 270 CHAR1,3,24,"PRESS ANY KEY FOR NEW GAME":GETKEY Y$:GOTO40
JS 280 POKE53269,0:POKE2902,1:COLOR1,16:PLAYM1$:SC=OS+900*LV
CP 290 CHAR1,5,22," PREPARE FOR LEVEL "+STR$(LV+1)+"{SPACE}",1:SLEEP3:GOTO60
HG 300 FORT=0TO7:READY:POKEDEC("0B14")+T,Y:NEXT:FORT=0TO1:READX(T),Y(T):NEXT
PJ 310 FORT=1TO18:READC1(T),C2(T):NEXT:FORT=1TO18:READNS(T),SP(T):NEXT
KC 320 V=8192:G=-1:FORT=0TO23:FORU=0TO7:W=V+U+320*T
RH 330 G=G+1:POKE6656+G,W-INT(W/256)*256:POKE6912+G,INT(W/256):NEXT:NEXT
GJ 340 M1$="V203T7U7WAIBIAIBIAIBIAIBIAIBIAIBQDICSBQFIESDICIBWAQG"
RD 350 M2$="V202T7U8QBQAHBHCQGQFHEQDQCIBIAQBICIDICWAQG"
QD 360 BLOAD"ML-BRUSHER",B0,P4864
EA 370 FORT=0TO10:Z=32+(T+(T=10))*24:POKE2848+T,Z:ZX(T)=Z
KP 380 Z=48+T*16:POKE2864+T,Z:ZY(T)=Z:NEXT:RETURN
PP 390 CHAR1,31,6," BEST {3 SPACES}",1:CHAR1,31,7," SCORE{2 SPACES}",1:BT$=STR$(BS):LV$=STR$(LV+1)
QJ 400 CHAR1,38-LEN(BT$),10,BT$:COLOR1,8:CHAR1,31,1," LEVEL{2 SPACES}",1:CHAR1,36,3,LV$
BX 410 COLOR1,13:CHAR1,8,24," {SPACE}B R U S H E R ",1:COLOR1,C1(YC):RETURN
RF 420 COLOR1,C2(YC):CHAR1,31,12," YOUR{3 SPACES}",1
CG 430 CHAR1,31,13," SCORE {2 SPACES}",1:COLOR1,C1(YC):GOSUB240:RETURN
JR 440 COLOR1,5:CHAR1,31,18,"BRUSHES":CHAR1,36,20,STR$(ML):COLOR1,C1(YC):RETURN
GS 450 FORT=2TONS(L):MOVSPRT,X(INT(RND(1)*2)),Y(INT(RND(1)*2)):NEXT
EM 460 POKE2949,0:POKE2826,0
EQ 470 GOSUB490:POKE53269,2↑NS(L)-1:RETURN
QQ 480 GOSUB490:POKE53269,PEEK(53269)OR128:RETURN
RS 490 MOVSPR8,ZX(INT(RND(1)*11)),ZY(INT(RND(1)*11)):RETURN
RG 500 DATA192,192,48,48,12,12,3,3,32,48,248,208,2,3,3,2,8,7,7,8,11,6,6,11
MA 510 DATA15,9,9,15,14,12,12,14,5,8,8,14,3,15,15,3,5,5,6,2,2,4,4,5,2,3,2,2,3,3
QH 520 DATA3,2,4,3,4,2,5,4,5,3,5,2,6,5,6,4,6,3,6,2,7,5,7,4,7,3,7,2,7,2
```

Program 2: Brusher ML

```
1300:AD D6 11 8D 00 0B 38 E9 34
1308:10 8D 01 0B 8D 02 0B AD A2
1310:D7 11 8D 03 0B 38 E9 28 7D
1318:8D 04 0B AD 04 0B A8 B9 99
1320:00 1A 85 FA B9 00 1B 85 B6
1328:FB AD 01 0B 4A 4A 4A 8D 26
1330:05 0B AD 05 0B F0 10 A5 83
1338:FA 18 69 08 85 FA 90 02 CA
1340:E6 FB CE 05 0B D0 EB AD 24
1348:02 0B 29 07 AA A0 00 B1 51
1350:FA 1D 14 0B 91 FA 60 BD 65
1358:D6 11 C9 20 F0 03 DE D6 91
1360:11 60 BD D7 11 C9 30 F0 5D
1368:03 DE D7 11 60 EA BD D6 D4
1370:11 C9 F8 F0 06 FE D6 11 AA
1378:FE 00 04 60 BD D7 11 C9 DD
1380:D0 F0 06 FE D7 11 FE 00 FC
1388:04 60 A9 00 8D 06 0B A0 39
1390:0A B9 1F 0B CD 00 0B F0 34
1398:04 88 D0 F5 60 A0 0B B9 B1
13A0:2F 0B CD 03 0B F0 04 88 B7
13A8:D0 F5 60 A9 01 8D 06 0B B0
13B0:60 AD D6 11 8D 00 0B AD 8E
13B8:D7 11 8D 03 0B 20 8A 13 F1
13C0:60 AD 09 0B F0 01 60 A9 4A
13C8:01 8D 15 D0 8D 0A 0B 8D BA
13D0:09 0B 60 AD 00 DC 8D 08 BB
13D8:0B 29 10 D0 03 20 C1 13 0D
13E0:AD 08 0B 29 0F C9 0E D0 60
13E8:08 A9 01 8D 07 0B 4C 15 88
13F0:14 C9 07 D0 08 A9 02 8D F9
13F8:07 0B 4C 15 14 C9 0D D0 F2
1400:08 A9 03 8D 07 0B 4C 15 E1
1408:14 C9 0B D0 16 A9 04 8D 08
1410:07 0B EA EA EA 20 B1 13 D8
```

```
1418:AD 06 0B F0 06 AD 07 0B 09
1420:8D 0B 0B A2 00 AD 0B 0B 35
1428:C9 01 D0 03 4C 62 13 C9 9B
1430:02 D0 03 4C 6E 13 C9 03 09
1438:D0 03 4C 7C 13 4C 57 13 66
1440:AD 40 0B AA 4A A8 60 20 31
1448:40 14 B9 0B 0B C9 01 D0 CF
1450:04 20 62 13 60 C9 02 D0 FE
1458:04 20 6E 13 60 C9 03 D0 8A
1460:04 20 7C 13 60 20 57 13 98
1468:60 AD 40 0B C9 02 D0 01 DD
1470:60 CE 40 0B CE 40 0B 4C 0F
1478:BB 14 20 40 14 EE 2E 0B 4F
1480:AD 2E 0B 29 03 8D 2E 0B B4
1488:C9 01 30 15 BD D6 11 38 D0
1490:ED D6 11 30 06 A9 04 99 03
1498:0B 0B 60 A9 02 99 0B 0B 47
14A0:60 BD D7 11 38 ED D7 11 AE
14A8:30 06 A9 01 99 0B 0B 60 1F
14B0:A9 03 99 0B 0B 60 A9 0C 8B
14B8:8D 40 0B AD 40 0B AA BD 35
14C0:D6 11 8D 00 0B BD D7 11 5A
14C8:8D 03 0B 20 8A 13 AD 06 DD
14D0:0B F0 03 20 7A 14 20 47 C8
14D8:14 4C 69 14 AD 0A 0B D0 09
14E0:03 20 B6 14 60 A5 FA 8D C7
14E8:50 0B A5 FB 8D 51 0B 60 98
14F0:AD 50 0B 85 FA AD 51 0B F9
14F8:85 FB 60 A5 FB 85 FD A5 E0
1500:FA 85 FC 60 A5 FA 18 69 61
1508:08 85 FA 90 02 E6 FB A5 49
1510:FC 18 69 08 85 FC 90 02 AF
1518:E6 FD 60 A5 FC 8D 52 0B 69
1520:A5 FD 8D 53 0B 60 AD 52 0B
1528:0B 85 FC AD 53 0B 85 FD 83
1530:60 A5 FC 85 FA A5 FD 85 DB
1538:FB E6 FB E6 FB A5 FA 18 8C
1540:69 80 85 FA 90 02 E6 FB F5
1548:60 A5 FC 85 FA A5 FD 85 F3
1550:FB 60 20 49 15 A5 FA 18 76
1558:69 18 85 FA 90 02 E6 FB F3
1560:60 E6 FA D0 02 E6 FB E6 6B
1568:FC D0 02 E6 FD 60 E6 FD 31
1570:A5 FC 18 69 38 85 FC 90 A8
1578:02 E6 FD E6 FB A5 FA 18 10
1580:69 38 85 FA 90 02 E6 FB 24
1588:60 E6 FB A5 FA 18 69 40 C1
1590:85 FA 90 02 E6 FB 60 A2 F8
1598:00 A9 03 85 FE A1 FA C9 24
15A0:FF F0 01 60 A1 FC C9 FF C1
15A8:F0 01 60 20 04 15 C6 FE 9A
15B0:D0 EB 20 26 15 20 52 15 87
15B8:A9 02 85 FE A9 08 8D 54 B5
15C0:0B A1 FA 29 C0 C9 C0 F0 6A
15C8:01 60 A1 FC 29 C0 C9 C0 30
15D0:F0 01 60 20 61 15 CE 54 13
15D8:0B D0 E6 20 6E 15 C6 FE EF
15E0:D0 DA A1 FA 29 C0 C9 C0 AE
15E8:F0 01 60 20 26 15 20 49 E8
15F0:15 20 89 15 A9 18 85 FE E7
15F8:A9 AA 81 FA 81 FC 20 61 24
1600:15 C6 FE D0 F3 20 26 15 D6
1608:20 31 15 A9 03 85 FE A9 A3
1610:FF 81 FA 81 FC 20 04 15 99
1618:C6 FE D0 F3 20 26 15 20 A4
1620:52 15 A9 02 85 FE A9 08 93
1628:8D 54 0B A1 FA 09 C0 81 AA
1630:FA A1 FC 09 C0 81 FC 20 98
1638:61 15 CE 54 0B D0 EC 20 0F
1640:6E 15 C6 FE D0 E0 A1 FA F9
1648:09 C0 81 FA 60 20 E5 14 6C
1650:20 FB 14 C6 FD C6 FD A5 27
1658:FC 38 E9 98 85 FC B0 02 5B
1660:C6 FD 20 1B 15 20 31 15 C5
1668:20 97 15 20 F0 14 20 FB 43
1670:14 C6 FD C6 FD A5 FC 38 3D
1678:E9 80 85 FC B0 02 C6 FD 53
1680:20 1B 15 20 31 15 20 97 DD
1688:15 20 F0 14 20 FB 14 A5 65
1690:FC 38 E9 18 85 FC B0 02 8B
1698:C6 FD 20 1B 15 20 31 15 FD
16A0:20 97 15 20 F0 14 20 FB 7B
16A8:14 20 1B 15 20 31 15 20 AB
16B0:97 15 60 AD D6 11 8D 00 EA
16B8:0B AD D7 11 8D 03 0B 20 90
16C0:8A 13 AD 06 0B D0 01 60 0B
16C8:4C 4D 16 A9 00 8D 60 0B CD
16D0:8D 61 0B 8D 55 0B AA A9 2C
16D8:22 85 FB 85 FD A9 98 85 9C
16E0:FA 85 FC A0 0A A9 09 85 24
16E8:FE A1 FA C9 AA F0 11 20 54
16F0:55 15 C6 FE D0 F3 20 31 9D
16F8:15 20 FB 14 88 D0 E6 60 2E
1700:EE 55 0B AD 55 0B C9 5A FB
1708:D0 05 A9 01 8D 75 0B EE 6C
1710:60 0B D0 DB EE 61 0B 4C 68
1718:EF 16 AD 57 0B C9 64 D0 08
1720:05 A9 5F 8D 57 0B EE 57 1C
1728:0B AD 58 0B C9 06 D0 05 10
1730:A9 00 8D 58 0B AA AD 57 20
1738:0B 9D F9 1F EE 58 0B AD 21
1740:59 0B C9 06 30 05 A9 01 61
1748:8D 59 0B AA AD 65 0B 9D 56
1750:27 D0 CE 65 0B EE 59 0B 48
1758:60 EA EA 00 AD 1E D0 8D E3
1760:5B 17 AD 5B 17 29 81 C9 97
1768:81 F0 0F AD 5B 17 29 01 DA
1770:F0 0B A9 01 8D 63 0B 8D BC
1778:56 0B 8D 85 0B 60 15 D0 73
1780:78 A9 8D 8D 14 03 A9 17 F6
1788:8D 15 03 58 60 AD 56 0B 1A
1790:F0 03 4C 65 FA 20 00 13 43
1798:20 B3 16 20 D3 13 20 CB 7F
17A0:16 20 1A 17 20 5C 17 AD E4
17A8:62 0B D0 0B 20 DC 14 20 52
17B0:DC 14 A9 03 8D 62 0B CE 92
17B8:62 0B 4C 65 FA 00 00 00 92
17C0:00 00 00 00 00 00 00 00 EE
17C8:00 00 00 00 00 00 00 00 F6
17D0:00 00 00 04 00 00 0E 00 5B
17D8:00 1C 00 01 F8 00 03 B0 9C
17E0:00 07 70 00 03 E0 00 01 7B
17E8:C0 00 00 80 00 00 00 00 7F
17F0:00 00 00 00 00 00 00 00 1F
17F8:00 00 00 00 00 00 00 00 27
1800:00 00 00 00 00 00 00 00 30
1808:00 00 00 00 00 00 00 00 38
1810:00 00 01 F0 00 06 FC 00 81
1818:0E FE 00 0F 7E 00 0F 7E 90
1820:00 0F BE 00 0F DE 00 07 E6
1828:EC 00 01 F0 00 00 00 00 FD
1830:00 00 00 00 00 00 00 00 60
1838:00 00 00 00 00 00 00 00 68
1840:00 00 00 00 00 00 00 00 70
1848:00 00 00 00 00 00 00 00 78
1850:00 00 01 F0 00 07 FC 00 C5
1858:0B FE 00 0D FE 00 0E FE B1
1860:00 0F 3A 00 0F C6 00 07 36
1868:FC 00 01 F0 00 00 00 00 46
1870:00 00 00 00 00 00 00 00 A0
1878:00 00 00 00 00 00 00 00 A8
1880:00 00 00 00 00 00 00 00 B0
1888:00 00 00 00 00 00 00 00 B8
1890:00 00 01 F0 00 07 FC 00 06
1898:0F FE 00 0F FE 00 07 FA 02
18A0:00 0D E6 00 0E 1E 00 07 E0
18A8:FC 00 01 F0 00 00 00 00 86
18B0:00 00 00 00 00 00 00 00 E0
18B8:00 00 00 00 00 00 00 00 E8
18C0:00 00 00 00 00 00 00 00 F0
18C8:00 00 00 00 00 00 00 00 F8
18D0:00 00 01 F0 00 07 DC 00 06
18D8:0F EE 00 0F EE 00 0F EE C1
18E0:00 0F EE 00 0F 9E 00 07 AC
18E8:7C 00 01 F0 00 00 00 00 86
18F0:00 00 00 00 00 00 00 00 21
18F8:00 00 00 00 00 00 00 00 29
1900:00 00 00 00 00 00 00 00 32
1908:00 00 00 00 00 00 00 00 3A
1910:00 00 01 F0 00 07 FC 00 87
1918:0C 7E 00 0F BE 00 0F DE D3
1920:00 0F EE 00 0F EE 00 07 2F
1928:FC 00 01 F0 00 00 00 00 08
1930:00 00 00 00 00 00 00 00 62
1938:00 00 00 00 00 00 00 00 6A
1940:00 00 00 00 00 00 00 00 72
1948:00 00 00 00 00 00 00 00 7A
1950:00 00 01 F0 00 07 FC 00 C7
1958:0F FE 00 0C 7E 00 0B 86 23
1960:00 0F FA 00 0F FE 00 07 31
1968:FC 00 01 F0 00 00 00 00 48
1970:00 00 00 00 00 00 00 00 A2
1978:00 00 00 00 00 00 00 00 AA
1980:00 00 00 00 00 00 00 00 B2
1988:00 00 00 00 00 00 00 00 BA
1990:88 00 08 00 00 00 C2 00 8D
1998:03 F0 00 23 F0 00 07 F9 4A
19A0:00 03 F0 00 13 F0 00 00 0E
19A8:C2 00 04 00 00 00 88 00 CD
19B0:00 00 00 00 00 00 00 00 E2
19B8:00 00 00 00 00 00 00 FF EA
19C0:00 00 00 00 00 00 00 00 F2
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The GEOS Column

See instructions in article on page 66 before typing in.

Program 1: File Converter

```
1503:BF FF FF FF 80 00 01 80 93
150B:7F 01 80 08 01 80 08 01 E0
1513:80 08 01 80 7C 01 82 4A DE
151B:01 82 49 01 81 F1 01 80 F5
1523:41 01 BF E1 01 82 41 01 D9
152B:82 41 01 82 42 01 82 7C C6
1533:01 82 00 01 82 00 01 82 27
153B:C0 01 80 00 01 FF FF FF 1E
1543:82 06 00 FA 04 94 0F FC 6D
154B:04 66 69 6C 65 73 61 76 37
1553:65 72 00 00 00 00 00 00 CC
155B:00 00 00 00 00 00 00 00 85
1563:00 00 00 00 00 00 00 00 8D
156B:00 00 00 00 00 00 00 00 95
1573:00 00 00 00 00 00 00 00 9D
157B:00 00 00 00 00 00 00 00 A5
1583:00 00 00 00 00 00 00 00 AD
158B:00 00 00 00 00 00 00 00 B5
1593:00 00 00 00 00 00 00 00 BD
159B:00 00 00 00 00 00 00 00 C5
15A3:00 00 00 00 00 00 00 00 CD
15AB:00 00 00 00 00 00 00 00 D5
15B3:00 00 00 00 00 00 00 00 DD
15BB:00 00 00 00 00 00 00 00 E5
15C3:00 00 00 00 00 00 00 00 ED
15CB:00 00 00 00 00 00 00 00 F5
15D3:00 00 00 00 00 00 00 00 FD
15DB:00 00 00 00 00 00 00 00 06
15E3:00 00 00 00 00 00 00 00 0E
15EB:00 00 00 00 00 00 00 00 16
15F3:00 00 00 00 00 00 00 00 1E
15FB:00 00 00 00 FC 04 AD A5 1F
1603:8C 85 79 A9 07 85 78 20 FF
160B:C5 05 4C F1 05 00 A9 17 96
1613:A0 05 8D A9 84 8C AA 84 4D
161B:60 AD 05 85 10 01 60 A5 C6
1623:18 48 A5 19 48 AD 08 04 C0
162B:AC 09 04 85 20 84 21 A2 C0
1633:FF 86 1E A0 00 B1 20 C0 96
163B:06 D0 13 C9 FF F0 37 98 68
1643:18 65 20 85 20 90 02 E6 5F
164B:21 A0 00 4C 33 05 99 06 DB
1653:00 C8 C0 06 D0 DF E6 1E 1C
165B:20 B3 C2 10 D8 A5 1E 85 FC
1663:1F 0A A8 B9 F3 08 8D 7C A9
166B:05 C8 B9 F3 08 8D 7D 05 39
1673:20 7E 05 20 7B 05 68 85 38
167B:19 68 85 18 60 4C 00 00 B4
1683:A5 1E C9 0D B0 40 AD 0B 01
168B:05 C9 FF F0 1A 0A 0A 6D 36
1693:0B 05 6D 0B 05 AA A0 00 F8
169B:BD 8C 08 99 06 00 E8 C8 2F
16A3:C0 06 D0 F4 20 2A C1 A5 ED
16AB:1E 0A 0A 65 1E 65 1E AA 6E
16B3:A0 00 BD 8C 08 99 06 00 63
16BB:E8 C8 C0 06 D0 F4 20 2A CB
16C3:C1 A5 1E 8D 0B 05 60 EA EE
16CB:A9 A5 A0 8C A2 00 85 02 35
16D3:84 03 A0 00 A5 78 91 02 4B
16DB:C8 C0 1B F0 02 D0 F5 18 66
16E3:A9 28 65 02 90 02 E6 03 19
16EB:85 02 E8 E0 10 F0 03 4C 1D
16F3:D0 05 60 A9 00 85 7E 85 09
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16FB:7F 85 7D 85 7C A9 FF 8D 69
1703:0B 05 A0 00 8C 0B 04 98 3D
170B:99 20 04 C8 C0 11 F0 02 49
1713:D0 F6 EA A9 00 20 39 C1 14
171B:20 79 0D 20 9F C1 20 A0 40
1723:28 00 00 01 20 A8 C1 01 9D
172B:28 00 20 07 00 01 A0 01 28
1733:32 00 28 07 8C 00 36 01 C1
173B:32 00 39 07 5A 00 47 01 7C
1743:32 00 4A 07 5A 00 58 01 C8
174B:32 00 5B 07 5A 00 69 01 15
1753:32 00 6E 07 3A 00 76 01 98
175B:32 00 79 07 3A 00 81 01 18
1763:32 00 84 07 3A 00 8C 01 97
176B:32 00 8F 07 3A 00 97 01 17
1773:69 00 6E 07 71 00 76 01 0E
177B:69 00 79 07 71 00 81 01 8D
1783:69 00 84 07 71 00 8C 01 0D
178B:69 00 8F 07 71 00 97 01 8C
1793:A0 00 6E 07 A8 00 76 01 83
179B:A0 00 79 07 A8 00 81 01 03
17A3:A0 00 84 07 A8 00 8C 01 82
17AB:A0 00 8F 07 A8 00 97 01 02
17B3:D2 00 28 07 FC 00 38 01 1A
17BB:D2 00 3B 07 FC 00 4B 01 AA
17C3:D2 00 4E 07 FC 00 5E 01 3B
17CB:D2 00 61 07 FC 00 71 00 CA
17D3:20 AE C1 91 00 34 18 19 29
17DB:C6 49 4C 45 4E 41 4D 45 F4
17E3:00 20 AE C1 64 00 45 CC 86
17EB:4F 41 44 20 41 44 44 52 92
17F3:45 53 53 00 20 AE C1 64 A7
17FB:00 56 D2 55 4E 20 41 44 29
1803:44 52 45 53 53 00 20 AE 51
180B:C1 64 00 67 C5 4E 44 20 BB
1813:41 44 44 52 45 53 53 1B DB
181B:00 20 AE C1 3E 00 76 42 66
1823:41 53 49 43 00 20 AE C1 C5
182B:3E 00 81 41 53 53 45 4D 7E
1833:42 4C 59 00 20 AE C1 3E 40
183B:00 8C 44 41 54 41 00 20 F2
1843:AE C1 3E 00 97 53 59 53 13
184B:54 45 4D 00 20 AE C1 75 55
1853:00 76 41 43 43 45 53 2E 81
185B:00 20 AE C1 75 00 81 41 75
1863:50 50 4C 49 43 2E 00 20 E0
186B:AE C1 75 00 8C 41 55 54 7A
1873:4F 2D 45 58 45 2E 00 20 C7
187B:AE C1 75 00 97 46 4F 4E E4
1883:54 00 20 AE C1 AC 00 76 04
188B:50 52 49 4E 54 45 52 00 E2
1893:20 AE C1 AC 00 81 49 4E 69
189B:50 55 54 00 20 AE C1 AC BF
18A3:00 8C 44 49 53 4B 20 44 60
18AB:45 56 2E 00 20 AE C1 AC C5
18B3:00 97 53 59 53 2D 42 4F EC
18BB:4F 54 00 20 AE C1 D7 00 D6
18C3:33 18 20 44 49 53 4B 00 0A
18CB:20 AE C1 D5 00 46 20 44 EA
18D3:52 49 56 45 00 20 AE C1 3E
18DB:D5 00 59 20 53 41 56 45 B5
18E3:00 20 AE C1 D5 00 6C 43 D8
18EB:41 4E 43 45 4C 1B 00 A9 85
18F3:8C A0 08 8D 08 04 8C 09 DE
18FB:04 20 0C 05 A9 20 A0 04 1B
1903:85 02 84 03 A9 33 85 05 63
190B:A9 36 A0 00 85 18 84 19 62
1913:20 48 C1 A9 28 A0 08 8D 9B
191B:A3 84 8C A4 84 A9 33 85 D2
1923:05 A9 36 A2 00 85 18 86 FF
192B:19 60 AC 0B 04 C0 10 F0 7C
1933:24 AD 04 85 C9 0D F0 3F 5F
193B:C9 1D D0 28 20 03 0D A0 FD
1943:00 98 99 20 04 C8 C0 11 A6
194B:F0 02 D0 F6 A0 00 8C 0B 29
1953:04 20 FA 07 60 20 48 0D 80
195B:A0 00 8C 0B 04 20 03 0D D3
1963:20 FA 07 60 C9 1F 90 0E 45
196B:C9 7B B0 0A 99 20 04 C8 36
1973:8C 0B 04 20 45 C1 60 A9 CC
197B:00 99 20 04 A9 FF 85 7E 2F
1983:A0 00 8C 0B 04 8C A3 84 66
198B:8C A4 84 4C 8D 09 61 71 47
1993:D2 00 FC 00 6E 76 32 00 80
199B:3A 00 79 81 32 00 3A 00 38
19A3:84 8C 32 00 3A 00 8F 97 0A
19AB:32 00 3A 00 6E 76 69 00 5E
19B3:71 00 79 81 69 00 71 00 14
19BB:84 8C 69 00 71 00 8F 97 C2
19C3:69 00 71 00 6E 76 A0 00 67
19CB:A8 00 79 81 A0 00 A8 00 EF
19D3:84 8C A0 00 A8 00 8F 97 7B
19DB:A0 00 A8 00 28 38 D2 00 3B
19E3:FC 00 3B 4B D2 00 FC 00 41
19EB:4E 5E D2 00 FC 00 28 36 A5
19F3:32 00 82 00 FF 15 09 1F 15
19FB:09 1F 09 1F 09 1F 09 1F 83
1A03:09 1F 09 1F 09 1F 09 1F 8C
1A0B:09 1F 09 1F 09 1F 09 3E B3
1A13:09 6A 09 21 0A 85 0C A5 BD
1A1B:79 85 78 20 C5 05 4C 2C 85
1A23:C2 EA A5 1F C9 04 B0 07 E0
1A2B:A0 80 84 7C 4C 36 09 A0 16
1A33:00 84 7C C9 07 D0 01 0A 3C
1A3B:8D D7 0D A9 FF 85 7F 60 DD
1A43:A9 50 A0 09 85 02 84 03 45
1A4B:20 56 C2 20 A1 C2 20 FA D2
1A53:07 60 81 0B 10 32 58 09 07
1A5B:0E 00 18 C9 4E 53 45 52 D2
1A63:54 20 CE 45 57 20 C4 49 06
1A6B:53 4B 1B 00 AD 89 84 C9 E5
1A73:08 F0 04 C9 09 F0 0C A9 D2
1A7B:09 20 B0 C2 20 A1 C2 20 AB
1A83:FA 07 60 A9 08 20 B0 C2 82
1A8B:20 A1 C2 20 FA 07 60 A9 F0
1A93:20 A0 04 85 0E 84 0F 20 99
1A9B:0B C2 8A F0 07 20 E3 09 EF
1AA3:20 F1 05 60 A0 01 B1 0C 83
1AAB:85 04 C8 B1 0C 85 05 A9 02
1AB3:00 A0 80 85 0A 84 0B 20 11
1ABB:E4 C1 A0 02 B9 00 80 85 5B
1AC3:70 85 72 85 74 C8 B9 00 72
1ACB:80 85 71 85 73 85 75 A9 6E
1AD3:00 A0 10 85 10 84 11 A9 E8
1ADB:00 A0 50 85 06 84 07 20 0B
1AE3:FF C1 8A F0 03 4C 77 0A 2B
1AEB:A5 11 85 77 E9 10 85 11 0B
1AF3:18 A5 10 85 76 65 72 85 AB
1AFB:72 90 02 E6 73 A5 11 65 F5
1B03:73 85 73 A5 74 18 69 02 F5
1B0B:85 74 90 02 E6 75 EA EA 21
1B13:EA A0 00 B9 20 04 99 DF A6
1B1B:0D C0 10 F0 03 C8 D0 F3 E9
1B23:4C 88 0A A5 7E D0 09 A2 29
1B2B:0E 20 77 0A 20 22 06 60 F5
1B33:A5 7F D0 09 A2 0F 20 77 CF
1B3B:0A 20 CE 06 60 A9 20 A0 43
1B43:04 85 02 84 03 A9 00 A0 C4
1B4B:84 85 08 84 09 20 44 C2 82
1B53:A9 92 A0 0D 85 14 84 15 82
1B5B:A9 00 85 16 A9 00 A0 10 17
1B63:8D D9 0D 8C DA 0D A5 76 0E
1B6B:8D DB 0D A5 77 8D DC 0D 14
1B73:20 ED C1 8A D0 03 4C 4C 8D
1B7B:0C 86 FB A9 DC A0 0A 85 76
1B83:02 84 03 20 F8 0A 20 56 C4
1B8B:C2 60 A9 3C A0 00 85 18 5C
1B93:84 19 A0 44 84 05 A5 70 9E
1B9B:A4 71 85 02 84 03 A9 F3 C8
1BA3:20 84 C1 A9 3C A0 00 85 C7
1BAB:18 84 19 A0 55 84 05 A5 A8
1BB3:74 A4 75 85 02 84 03 A9 26
1BBB:F3 20 84 C1 A9 3C A0 00 20
1BC3:85 18 84 19 A0 66 84 05 91
1BCB:A5 72 A4 73 85 02 84 03 7D
1BD3:A9 F3 20 84 C1 A9 36 A0 E9
1BDB:00 85 18 84 19 60 81 01 0D
1BE3:11 48 0B 32 1E EA 0A 0C F5
1BEB:32 28 0C 00 C4 49 53 4B 04
1BF3:20 45 52 52 4F 52 20 2D 2C
1BFB:2D 00 C6 FB A5 FB C9 1F 31
1C03:90 02 A9 0F 0A A8 B9 10 A0
1C0B:0B 85 0C C8 B9 10 0B 85 E1
1C13:0D 60 30 0B 43 0B 52 0B 96
1C1B:65 0B 74 0B 84 0B 8C 0B 7C
1C23:9F 0B AF 0B BF 0B D3 0B 71
1C2B:E4 0B F9 0B 0B 0C 22 0C 61
1C33:38 0C CE 4F 54 20 45 4E 55
1C3B:4F 55 47 48 20 42 4C 4F CF
1C43:43 4B 53 2E 00 49 4E 56 55
1C4B:41 4C 49 44 20 54 52 41 DC
1C53:43 4B 2E 00 49 4E 53 55 45
1C5B:46 46 49 43 49 45 4E 54 F5
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1CD3:54 43 48 2E 00 42 55 46 EC
1CDB:46 45 52 20 4F 56 45 52 85
1CE3:46 4C 4F 57 2E 00 4F 50 12
1CEB:45 52 41 54 49 4F 4E 20 0D
1CF3:43 41 4E 43 45 4C 4C 45 55
1CFB:44 2E 00 44 45 56 49 43 7F
1D03:45 20 4E 4F 54 20 46 4F A5
1D0B:55 4E 44 2E 00 CE 4F 20 E8
1D13:46 49 4C 45 4E 41 4D 45 F7
1D1B:20 41 56 41 49 4C 41 42 D4
1D23:4C 45 2E 00 CE 4F 20 46 D4
1D2B:49 4C 45 54 59 50 45 20 C1
1D33:53 45 4C 45 43 54 45 44 80
1D3B:2E 00 43 48 45 43 4B 20 67
1D43:44 49 53 4B 20 4F 52 20 14
1D4B:44 52 49 56 45 00 A9 20 68
1D53:A0 04 85 0E 84 0F 20 0B 1C
1D5B:C2 A0 13 B1 0C 85 04 C8 E3
1D63:B1 0C 85 05 A9 00 A0 80 89
1D6B:85 0A 84 0B 20 E4 C1 20 64
1D73:24 0D A2 00 B5 70 9D 47 49
1D7B:80 E0 05 F0 03 E8 D0 F4 30
1D83:20 E7 C1 20 F1 05 60 A9 10
1D8B:FF 85 7D 20 03 0D 20 AE 14
1D93:C1 91 00 34 18 19 C1 D5 D4
1D9B:D4 C8 CF D2 20 20 20 1B 76
1DA3:00 A0 00 98 99 F3 0D C0 07
1DAB:0F F0 03 C8 D0 F6 A9 C3 10
1DB3:A0 0C 8D A3 84 8C A4 84 51
1DBB:A9 33 85 05 A9 36 A2 00 04
1DC3:85 18 86 19 60 AC 0B 04 F8
1DCB:C0 10 D0 0F 20 48 0D A0 52
1DD3:00 8C 0B 04 20 03 0D 20 1A
1DDB:9F 0C 60 AD 04 85 C9 0D A6
1DE3:F0 17 C9 1D F0 38 C9 1F 82
1DEB:90 0E C9 7B B0 0A 99 F3 B7
1DF3:0D C8 8C 0B 04 20 45 C1 16
1DFB:60 20 03 0D A0 00 8C 0B C8
1E03:04 20 CE 06 60 20 AE C1 26
1E0B:36 00 33 20 20 20 20 20 AC
1E13:20 20 20 20 20 20 20 20 4F
1E1B:20 20 20 20 00 60 A0 00 38
1E23:8C 0B 04 4C 85 0C A5 7C D1
1E2B:F0 09 A5 70 A4 71 85 74 48
1E33:84 75 60 38 A5 70 E9 02 63
1E3B:B0 02 C6 71 85 70 38 A5 44
1E43:74 E9 02 B0 02 C6 75 85 1B
1E4B:74 60 A9 54 A0 0D 85 02 9A
1E53:84 03 20 56 C2 60 81 0B A1
1E5B:10 1E 5C 0D 0E 00 D4 4F EC
1E63:4F 20 4D 41 4E 59 20 43 68
1E6B:48 41 52 41 43 54 45 52 C2
1E73:53 20 45 4E 54 45 52 45 90
1E7B:44 2E 00 EA A9 86 A0 0D C9
1E83:85 02 84 03 20 5A C1 60 12
1E8B:01 A0 00 64 00 00 0A 0A D4
1E93:01 01 00 00 20 04 03 15 BC
1E9B:BF FF FF FF 80 00 01 80 3E
1EA3:7F 01 80 08 01 80 08 01 8B
1EAB:80 08 01 80 7C 01 82 4A 89
1EB3:01 82 49 01 81 F1 01 80 A0
1EBB:41 01 BF E1 01 82 41 01 84
1EC3:82 41 01 82 42 01 82 7C 71
1ECB:01 82 00 01 82 00 01 82 D1
1ED3:C0 01 80 00 01 FF FF FF C8
1EDB:82 00 00 00 00 00 00 00 59
1EE3:00 00 00 00 00 00 00 00 20
1EEB:00 00 00 00 00 00 00 00 28
```

```
1EF3:00 00 00 00 00 00 00 00 30
1EFB:00 00 00 00 00 00 00 00 38
1F03:00 00 00 00 00 00 00 00 41
1F0B:00 00 00 00 00 00 00 00 49
1F13:00 00 00 00 00 00 00 00 51
1F1B:00 00 00 00 00 00 00 00 59
1F23:00 00 00 00 00 00 00 00 61
1F2B:00 00 00 00 00 00 00 00 69
1F33:00 00 00 00 00 00 00 00 71
1F3B:00 00 00 00 00 00 00 00 79
1F43:00 00 00 00 00 00 00 00 81
1F4B:00 00 00 00 00 00 00 00 89
1F53:00 00 00 00 00 00 00 00 91
1F5B:00 00 00 00 00 00 00 00 99
1F63:00 00 00 00 00 00 00 00 A1
1F6B:00 00 00 00 00 00 00 00 A9
1F73:00 00 00 00 00 00 00 00 B1
1F7B:00 00 00 00 00 00 00 00 B9
1F83:00 00 00 00 00 00 00 00 C1
1F8B:00 00 00 00 00 00 00 00 C9
1F93:00 00 00 00 00 00 00 00 D1
```

Program 2: GeoConverter

```
HE 10 REM COPYRIGHT 1988 COMPU
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XG 20 REM THIS IS THE UPDATED
      {SPACE}GEOCONVERTER
      {8 SPACES}REVISED MAY IS
      SUE 1988 GAZETTE
AC 30 POKE 53280,0:POKE 53281,
      0:POKE 646,5:PRINTCHR$(1
      42);CHR$(147)
PS 40 FORI=1TO10:PRINT"{DOWN}"
      :NEXT
DX 50 PRINTTAB(5)"{4}UDI COPYR
      IGHT 1988"
SP 60 PRINTTAB(5)"GCH COMPUTE!
       PUBLICATIONS INC."
SP 70 PRINTTAB(5)"JFK ALL RIGH
      TS RESERVED{HOME}"
EP 80 PRINT"{DOWN}{RVS}{8}GEOC
      ONVERTER 1.1{OFF}{DOWN}
      {GRN}"
AP 90 INPUT"FILE TO CONVERT";G
      F$
CX 100 PRINT"{DOWN}SEARCHING F
       OR "GF$
PA 110 HD$="":FOR I=1 TO 4:REA
       D HE:HD$=HD$+CHR$(HE):N
       EXT
FK 120 FOR I=1TO5:READIE:ID$=I
       D$+CHR$(IE):NEXT
GD 130 NL$="":T$=CHR$(18):S$=C
       HR$(1):OPEN 15,8,15,"I0
       :":OPEN 2,8,2,"#"
JX 140 GOSUB370:GET #2,NT$,NS$
KB 150 FOR E=0 TO 7
KQ 160 D$=NL$:GET#2,B$:I=1:IFB
       $=NL$ THEN220
AX 170 IF ASC(B$)<>130 THEN220
HM 180 GET#2,HT$,HS$:I=3:IF HS
       $="" THEN HS$=CHR$(0)
FH 190 GET#2,B$:I=I+1:IF B$=""
        THEN B$=CHR$(0)
FA 200 IF ASC(B$)=160 THEN220
GD 210 D$=D$+B$:GOTO190
RK 220 FOR I=I TO 31:GET#2,B$:
       NEXT
AX 230 IF D$=GF$ THEN260
EC 240 NEXT E:IF NT$=NL$ THEN2
       60
FX 250 T$=NT$:S$=NS$:GOTO140
CR 260 IF D$=NL$ THENPRINT"
       {DOWN}{RVS}FILE NOT FOU
       ND{OFF}":GOTO360
CP 270 PRINT"{DOWN}CONVERTING
       {SPACE}"GF$
MJ 280 DT$=T$:DS$=S$:T$=HT$:S$
       =HS$:GOSUB370
MB 290 GET#2,MT$,MS$:IF MS$=""
        THEN MS$=CHR$(0)
BM 300 FOR I=0 TO 65:GET #2,B$
       :NEXT
HG 310 GET#2,CT$,GT$:GOSUB370:
       PRINT#2,HD$;:GOSUB380:T
       $=DT$:S$=DS$:GOSUB370
FP 320 FOR I=0 TO 32*E+2:GET#2
       ,B$:NEXT
FQ 330 PRINT#2,MT$;MS$;:FORI=0
        TO 15:GET#2,B$:NEXT
GP 340 PRINT#2,HT$;HS$;CHR$(0)
       ;GT$;
KM 350 PRINT#2,ID$;:GOSUB380:P
       RINT:PRINTGF$" CONVERTE
       D"
ER 360 CLOSE2:CLOSE15:END
KA 370 U$="U1":GOTO390
RR 380 U$="U2"
KP 390 PRINT#15,U$;2;0;ASC(T$+
       "0");ASC(S$+"0")
AS 400 RETURN
FM 410 DATA 0,255,3,21,87,10,1
       ,0,0
```

Making It Work: Trap

Article on page 15.

```
MM 10 REM INITIALIZE VARIABLES
BG 20 CO=54272:RD=5:REM COLOR
      {SPACE}MEMORY OFFSET, NU
      MBER OF ROUNDS
EE 30 S1=0:S2=0:REM PLAYER 1 A
      ND 2'S SCORES
XD 40 B=102:BC=4:REM BORDER CH
      ARACTER AND COLOR
SH 50 R1=81:C1=2:R2=42:C2=6:RE
      M PLAYER 1 AND 2'S CHARA
      CTERS, COLORS
PK 60 B$="PRESS A FIRE BUTTON
      {SPACE}TO PLAY"
BF 70 C$="{36 SPACES}"
HH 80 REM
GJ 90 REM INITIALIZE VARIABLES
       FOR EACH ROUND
PA 100 P1=1474:P2=1494:REM INI
       TIAL SCREEN POSITIONS O
       F PLAYERS
DK 110 P3=1:P4=-1:REM INITIAL
       {SPACE}POSITIONAL INCRE
       MENTS FOR BOTH PLAYERS
QM 120 SC=0:REM SCORE COUNTER
SB 130 REM
KR 140 PRINT"{CLR}":REM SET UP
        PLAYFIELD
CX 150 POKE53281,15:POKE53280,
       15:REM SCREEN COLOR
KQ 160 REM DRAW BORDER
FC 170 FOR I=1064 TO 1064+39:P
       OKE I+CO,BC:POKE I,B:NE
       XT:REM TOP
MK 180 FOR I=1944 TO 1944+39:P
       OKE I+CO,BC:POKE I,B:NE
       XT:REM BOTTOM
DF 190 FOR I=1104 TO 1904 STEP
        40:POKE I+CO,BC:POKE I
       ,B:NEXT:REM LEFT SIDE
DG 200 FOR I=1143 TO 1943 STEP
        40:POKE I+CO,BC:POKE I
       ,B:NEXT:REM RIGHT SIDE
JK 210 REM DISPLAY PLAYER SCOR
       E
FK 220 PRINT"{HOME}{RED}
       {2 SPACES}PLAYER 1
       {14 SPACES}SCORE:"S1
DF 230 PRINT"{23 DOWN}{BLU}
       {2 SPACES}PLAYER 2
       {14 SPACES}SCORE:"S2;
PP 240 IF RD=0 THEN 560:REM EN
       D OF GAME?
XQ 250 POKE CO+P1,C1:POKE P1,R
       1:POKE CO+P2,C2:POKE P2
       ,R2:REM POSITION EACH P
       LAYER
CM 260 PRINT"{HOME}{4 DOWN}"SP
       C(2)"ROUND"5-RD+1;"
       {LEFT}: ";B$
JP 270 GOSUB 640:REM CHECK FIR
       E BUTTONS
JH 280 PRINT"{HOME}{4 DOWN}"SP
       C(2)C$
DQ 290 REM
GG 300 REM GAME LOOP
SH 310 J1=15-(PEEK(56321)AND15
       ):IF J1=0 THEN 360
FJ 320 IF J1=1 THEN P3=-40:GOT
       O 360:REM #1 JOYSTICK U
       P
XS 330 IF J1=2 THEN P3=40:GOTO
        360:REM #1 DOWN
XK 340 IF J1=4 THEN P3=-1:GOTO
        360:REM #1 LEFT
PH 350 IF J1=8 THEN P3=1:REM #
       1 RIGHT
BH 360 P1=P1+P3:REM UPDATE PLA
       YER 1 POSITION
PP 370 IF PEEK(P1)<>32 THEN W=
       2:GOTO 510:REM #1 COLLI
       SION?
XF 380 POKE P1+CO,C1:POKE P1,R
       1:REM NO, SO MOVE #1
GD 390 J2=15-(PEEK(56320)AND15
       ):IF J2=0 THEN 440
AD 400 IF J2=1 THEN P4=-40:GOT
       O 440:REM #2 UP
GA 410 IF J2=2 THEN P4=40:GOTO
        440:REM #2 DOWN
GD 420 IF J2=4 THEN P4=-1:GOTO
        440:REM #2 LEFT
RX 430 IF J2=8 THEN P4=1:REM #
       2 RIGHT
DX 440 P2=P2+P4:REM UPDATE PLA
       YER 2 POSITION
CR 450 IF PEEK(P2)<>32 THEN W=
       1:GOTO 510:REM #2 COLLI
       SION?
MK 460 POKE P2+CO,C2:POKE P2,R
       2:REM NO, SO MOVE #2
DX 470 SC=SC+1:REM UPDATE SCOR
       E COUNTER
BR 480 GOTO 310:REM NEXT MOVE
JJ 490 REM
SC 500 REM COLLISION, SO UPDAT
       E SCORE
EP 510 IF W=1 THEN S1=S1+SC*10
       +10:GOTO 530:REM #1 SCO
       RES
JS 520 S2=S2+SC*10+10:REM #2 S
       CORES
RC 530 FOR I=1 TO 750:NEXT:RD=
       RD-1:GOTO 100:REM DELAY
       , NEXT ROUND
XP 540 REM
SM 550 REM GAME OVER
XS 560 PRINT"{HOME}{10 DOWN}"S
       PC(15)"GAME OVER"
JR 570 IF S1=S2 THEN PRINTSPC(
       14)"IT'S A TIE!":GOTO 6
       00:REM TIE
SP 580 W=1:IF S2>S1 THEN W=2
QS 590 PRINTSPC(13)"PLAYER"W"W
       INS!"
JF 600 PRINTSPC(3)"{DOWN}"B$"
       {SPACE}AGAIN"
FF 610 GOSUB 640:RUN:REM NEXT
       {SPACE}GAME
RA 620 REM
QK 630 REM FIRE BUTTON ROUTINE
PB 640 J1=PEEK(56321) AND 16:J
       2=PEEK(56320) AND 16:IF
        J1=16 AND J2=16 THEN 6
       40
PX 650 RETURN
```

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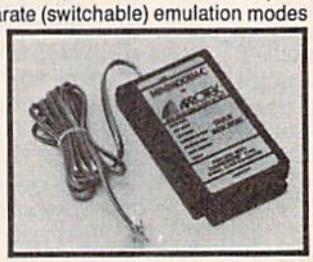

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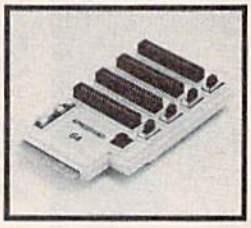

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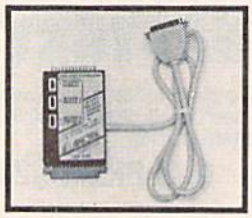

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MLX Machine Language Entry Program For Commodore 64 and 128

Ottis R. Cowper

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Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

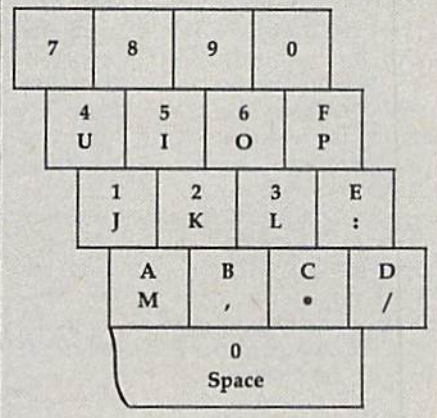
Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

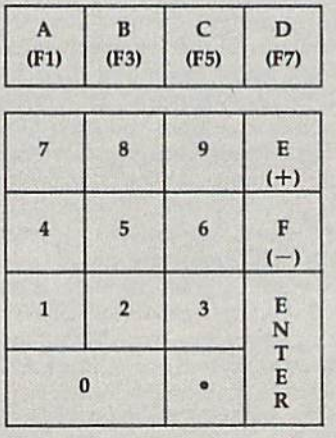
Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and − keys on the numeric keypad so that you can enter data one-handed. (The 64 version incorporates the keypad modification from the March 1986 "Bug-Swatter" column, lines 485–487.) In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures above show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

64 MLX Keypad



128 MLX Keypad



Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line

number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands (128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750 in 64 MLX), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk (DLOAD *"filename"* on the 128) or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1C01 for the 128. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk (BLOAD *"filename"* on the 128) or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

Program 1: MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
      I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
      4=254:Z5=255:Z6=256:Z7=
      127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
      :BS=PEEK(55)+Z6*PEEK(56
      ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
      :S$=" ":D$=CHR$(20):Z$=
      CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
      +23:POKE I,0:NEXT:POKE
      {SPACE}SD+24,15:POKE 78
      8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
      R$(8):POKE 53280,15:POK
      E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
      {2 SPACES}{8 @}
      {2 SPACES}"SPC(28)"
      {2 SPACES}{OFF}{BLU} ML
      X II {RED}{RVS}
      {2 SPACES}"SPC(28)"
      {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
      {3 SPACES}COMPUTE!'S MA
      CHINE LANGUAGE EDITOR
      {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
```

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1541 RAMBOard*

Byte The Copy Protection bullet!

Let's face it - war is hell. And in the Commodore world, one of the ugliest wars of all is being waged by the copy protection industry. They're tough. They're clever. And they're very, very determined. If you've seen some of the current ice out there, you know just how determined they are. Well, we're just as determined. And we've got a way to walk right through the coldest ice out there.

What's our secret? The new RAMBOard, a small card that can easily be installed in your 1541 in 5 minutes using just a screwdriver. With this remarkable piece of firmware in place, backup hassles are a thing of the past!

RAMBOard gives you speed - it comes bundled with a fast copier that can archive an unprotected data disk in under 60 seconds. RAMBOard gives you power - working with our dynamic Maverick software, RAMBOard will back up programs that other systems can't even scratch the surface of. Best of all, RAMBOard won't become obsolete - when newer, even tougher protection schemes come along, we'll create new Maverick/RAMBOard parameters to cut right through them. Backed by our famous R&D, you know that we'll do whatever it takes to keep RAMBOard operating behind enemy lines!

Get your RAMBOard today. And the next time some company tries to charge you for an "authorized" backup of a program you've already paid for, remind them that war IS hell - and you know how to raise a little hell of your own.

1541 & 1541C RAMBOard/ONLY $34.95

In Most Cases, Plugs Right In-NO Soldering Required

1541II RAMBOard/ONLY $44.95

This Version DOES Require Soldering

Profesional Installation Available-Contact Us For Details

***RAMBOard Is An Optional Accessory For Use With Maverick™**

NEW V2.0

MAVERICK™ *

NEW V2.0

A New Tool-From Some Old Friends

You know us. When copy protection began throwing 1541 drive heads out of alignment, we gave you Kracker Jax. When V-Max reared its ugly head, we created the Kracker Jax Elite series. When the copy protection wars escalated, we responded with Bull's-Eye and the Hacker's Utility Kit. And when you decided to explore the mysteries of commercial-grade protection schemes, we were there with Kracker Jax Revealed.

Now the copy protection industry has upped the ante again. They've made it harder than ever to make legitimate backups of your expensive software. Do you think you should have to spend money to buy "authorized" backups of software that you already own?

Neither do we.

Introducing Maverick, the best weapon we've ever made to let you defend yourself from copy protection profiteering. Maverick is so advanced, it has actually replaced every other backup utility we've ever created. That's right - Maverick is now the ONLY archival software we manufacture. All of our R&D efforts go into making sure that Maverick remains the most powerful backup utility available - from ANY source! Take a look at some of these features:

- NEW — 1541 1571 1581 fast file copier - any direction
- GCR Editor for the experienced hacker
- NEW — GEOS™ file copier - works under desktop
- Error scanner with unique sector editor
- Directory editor helps you organize your disks
- Works with C-64 C-128 & 1541 1571 1581 drives
- Scrolling M L monitor with Drive Mon
- EXLUSIVE Popular subscriber service available
- Single or dual state of the art Nibbler
- 300 + parameters for those tough to backup disks
- Capable of archiving Rapidlok protection
- Single of dual drive high speed data copier
- EXCLUSIVE GEOS™ Module: PARAMETERS & TOOLS
- NEW — Dump a formatted parameter catalog to printer
- Byte pattern scanner for high speed searches
- Technical support from our staff experts.

And this is just the beginning. Our future plans for Maverick include expanded RAMBOard support, RAM expansion module support, and even a 1541 1571 1581 relative file copier! And with our unique Subscriber Program, you can receive Maverick updates automatically - the instant they're released!

You know us. We're the company that has worked hard for years to establish an ironclad reputation for dynamic products, fair prices, and superb customer support. We've always been a part of your past. And as long as you have your Commodore, we'll always be a part of your future.

Attention: Registered Maverick owners!
Parameter Module #3 is now available, Only $9.95
Maverick V2.0 Upgrade also available, Only $9.95

MAVERICK 2.0/ONLY $34.95

Now Includes Parameter Modules 1, 2, & 3!

***Maverick Was Formerly Known As "Renegade" From Kracker Jax**
Not To Be Confused With The Game Of The Same Name

THE 1581 TOOLKIT

Without It, You Don't Know What You 1581 Is Capable Of

It blew people away at the "World Of Commodore Show" held in Pennsylvania in November 1988. It's power and scope astonish anyone who sees it work. And, if you have a 1581 drive, it is the single most important piece of software that you can own. It is The 1581 Toolkit-and it will transform your 1581 into something remarkable.

We know the market, and we know that if you've bought any other 1581 utility in the past, you've probably been disappointed. But while other companies rushed ill-conceived and poorly executed products to market to "cash in" on the new 1581 drive, we did things differently. Our programmers took the time to become experts on the 1581 before they even looked at a drawing board. So when they finished the Toolkit project a full year later, they had accomplished what no one else had - the creation of a tight, integrated package of essential utilities that make the 1581 more than the sum of its parts. Take a look at these Toolkit utilities and see why we're so excited about it:

- Fast Disk Copier
- Directory Editor
- File Track & Sector Tracer
- Fast File Copier
- Byte Pattern Search
- Ultrafast Formatter
- Partition Creator
- Track & Sector Editor
- Error Scanner
- Relocatable Fast Loader

All 10 of these custom utilities use extremely fast read/write routines. Wherever appropriate, they allow full access to partitions. It's obvious we created The 1581 Toolkit to be the finest set of utilities available for the 1581 drive. But we didn't stop there. Order now, and we'll also send you the 1581 DOS Reference Guide FREE! With over 100 pages of concise, valuable information, you'll quickly find this book indispensable! Written by David Martin (INFO Magazine's Copy Corner reviewer), this manual represents a year's worth of research and investigation into the inner workings of the 1581 drive. We've also added extra utilities, including such handy items as a machine language monitor with DriveMon, the perfect companion for the 1581 DOS Reference Guide.

We've spent a lot of time working hard to make sure that nobody knows more about the 1581 than we do. Don't sell your 1581 short. Get the 1581 Toolkit today, and let us show you just what it's really capable of. We'll take your 1581 absolutely as far as it was designed to go. And then we'll take it farther.

THE 1581 TOOLKIT (ON 3.5" DISK)/ONLY $39.95

Includes Your FREE 1581 DOS Reference Guide

The 1581 Toolkit Works On The C-64 Or The C-128/C-128D In The 64 Mode

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NEW LOW PRICE

SYSRES

Your Last Chance To Own A Classic.

All good things must come to an end. That's true for everything, including software. The time has come to say goodbye to an old friend - SYSRES, the finest BASIC enchancement system ever created for th Commodore computer.

Software Support owns the exclusive rights to produce SYSRES. Reluctantly, we've decided to stop producing this incredible program. Why? The simple fact is that most of the serious BASIC programmers out there already own SYSRES, and there aren't enough new BASIC programmers entering the arena to warrant the expense of continued production of SYSRES.

If you're one of the few serious BASIC programmers out there who isn't yet using SYSRES, maybe you should take a look at some of these features:

- Easy code entry with features like auto line numbering, enhanced key repeat, and fast up and down scrolling of program listings!
- Macros: any shifted key may be set to represent any BASIC or SYSRES KEYWORD. All files may be listed, loaded, run, copied, or scratched by entering a two character command in front of the file name listed in the directory!
- Find/Change any variable phrase or keyword used anywhere in your program. Over 700 search variations are available including pattern matching with wild cards and limitation symbols. Now you can automatically remove spaces and REMS to streamline run-time versions of your programs!

List BASIC programs and relative and sequential files without loading them into memory first!

- Edit text files and assembler source code without having to leave BASIC!
- Do a partial renumber. Move a subroutine to a more logical starting place while preserving all other line numbers and updating all line references!
- Debug with a variable speed TRACE. Display the current and the five previous operations. Display variables as they change or are defined; send the TRACE to the printer!

We haven't even scratched the surface of SYSRES. With features like screen print, multiple drive support, full printer support, and program merge capabilities, it's easy to see why SYSRES is the most comprehensive BASIC programmers' aid package ever produced. And just as comprehensive is the professional documentation: over 110 pages, bound in an attractive three ring binder. You'll also be pleased to know that SYSRES is UNprotected!

So there you have it. If you use BASIC at all, this is the enhancement system that you need. And this is absolutely your last chance to own this classic. As a going away present, we've even cut the price in half! Now there's no reason for you to limp by on plain vanilla BASIC any more. Get SYSRES today - and get involved with some serious programming power!

SYSRES/NOW ONLY $19.95

While Limited Supplies Last!

ATTENTION C-128 OWNERS

Solderless 64K Video RAM Upgrade

Now that Commodore has released the C-128D with 64K of video RAM, we should be seeing 128 programs address this fantastic new feature soon.

BASIC 8 already has the capability of using all 64K of video RAM. If you own the C-128 in stock condition, you own all 16K of video RAM that Commodore felt was necessary. Using Basic 8 format and the full 64K of video RAM provides you with the ability to scroll through video memory as well as enhanced color resolution.

Up until now, to upgrade the C-128 to 64K of video RAM you would have to first search out the components, then find a competent repair outlet to desolder and install the parts. **What a hassle!**

SOLUTION — We have developed a module that simply plugs in to the mother board of your C-128. **No splattered solder — No heat damage — No hassle.**

This package is available in two different forms. Model A has all parts necessary to complete your upgrade, and Model B is identical except that you supply the RAMs. Again, no soldering is necessary. If you have access to low cost RAMs, we suggest Model B.

Both models include easy to follow installation instructions, a test program to verify proper installation, and the plug in Video RAM Upgrade.

Model A (complete) only $49.95
Model B (no RAMs) only $29.95

FLASH! Kracker Jax Earns a 5 Star Rating In INFO's May-June '88 Issue

Kracker Jax is the powerful parameter based copying system that has taken the country by storm! What IS a parameter? It's a custom program that allows your 1541 or 1571 disk drive to strip ALL copy protection from your expensive software, leaving you with UNPROTECTED, TOTALLY BROKEN BACKUPS that can even be copied with a simple fast copier!

We declare **Kracker Jax** to be the best system of its kind on the market today! A bold claim? Maybe.

But don't take our word for it—if you want the REAL story on how good **Kracker Jax** is just ask one of our customers. Don't worry. You won't have any problem finding one.

Vols 1 thru 7 **Only $9.95 each**

NEW LOW PRICE

ALL NEW

KRACKER JAX REVEALED III

We've done it again!

Serious Commodore Users know why the Revealed Books by Kracker Jax are the last word in Commodore copy de-protection information. Our Knowledge of protection schemes has made us famous. Now find out how we do what we do best. Our books are your key to real knowledge. OTHERS ONLY SCRATCH THE SURFACE. We dig deep, much deeper. Not for the novice user, Kracker Jax Revealed Volume III takes you deep into the 1541 disk drive, where today's copy protection resides. If you have read and mastered the techniques set forth in Revealed I and II, you're ready for the next step - Kracker Jax Revealed III. Included as a free bonus is The Hacker's Utility Kit, one of the finest set of disk utilities gathered together in one package.

REVEALED BOOK III with Hacker's Utility Kit . . $23.50
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REVEALED BOOK I with Reset Board $23.50

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```
      RESS[4]";:GOSUB300:SA=A
      D:GOSUB1040:IF F THEN18
      0
GF 190 PRINT"{BLK}{2 SPACES}EN
      DING ADDRESS[4]";:GOSUB
      300:EA=AD:GOSUB1030:IF
      {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
      R WORKSPACE [Y/N][4]";A
      $:IF LEFT$(A$,1)<>"Y"TH
      EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
      ING...";:FORI=BS TO BS+
      EA-SA+7:POKE I,0:NEXT:P
      RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
      {BLK}{RVS} MLX COMMAND
      {SPACE}MENU {DOWN}[4]":
      PRINT T$"{RVS}E{OFF}NTE
      R DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISP
      LAY DATA":PRINT T$"
      {RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE
       FILE":PRINT T$"{RVS}Q
      {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
      MID$("EDLSQ",I,1)THEN A
      =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
      90,700,280:GOSUB1060:GO
      TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
      T"{DOWN}[4]ARE YOU SURE
       [Y/N]";A$:IF LEFT$(A$,
      1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
      LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
      =MID$(IN$,3):GOSUB320:A
      D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
      $(B$,J,1):B=ASC(A$)-C4+
      (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
      0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
      H$,B+1,1);:B=A-B*C6:PRI
      NT MID$(H$,B+1,1);:RETU
      RN
RR 360 A=INT(AD/Z6):GOSUB350:A
      =AD-A*Z6:GOSUB350:PRINT
      ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
      CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
      [4]";:GOSUB300:IF IN$<>
      N$ THEN GOSUB1030:IF F
      {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
      {SPACE}":GOSUB400:IF IN
      $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
       THEN PRINT IN$:PRINT"
      {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
      =S$:FOR J=1 TO 2:IF F T
      HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
      24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
      $>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-
      3*(A$=".")-4*(A$="/")-5
      *(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":
      ")-9*(A$="U")-10*(A$="I
      ")-11*(A$="O")-12*(A$="
      P")
CM 487 A=A-13*(A$=S$):IF A THE
      N A$=MID$("ABCD123E456F
      0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
      =1)OR F)THEN PRINT B$;:
      J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
      NT B$:J=2:NEXT:I=24:NEX
      T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
      ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
      ((I=0)AND(J=1))THEN GOS
      UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
      :J=2-J:IF J THEN PRINT
      {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
      {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
      {5 RIGHT}";:INPUT#3,IN$
      :IF IN$=N$ THEN CLOSE3:
      GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
      MID$(IN$,I):GOSUB320:IF
       I<25 THEN GOSUB380:A(I
      /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
      B1060:PRINT"{BLK}{RVS}
      {SPACE}ERROR: REENTER L
      INE [4]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
      R I=0 TO 7:POKE B+I,A(I
      ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
      LOSE3:PRINT"{DOWN}{BLU}
      ** END OF ENTRY **{BLK}
      {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
      {SPACE}DISPLAY DATA ":G
      OSUB400:IF IN$=N$ THEN2
      20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAU
      SE, {RVS}RETURN{OFF} TO
       BREAK[4]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
      I=BTO B+7:A=PEEK(I):GOS
      UB350:GOSUB380:PRINT S$
      ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
      :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
      ENPRINT"{DOWN}{BLU}** E
      ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
      SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
      UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
      {SPACE}DATA ":OP=1:GOTO
      710
PC 700 PRINT"{DOWN}{RVS} SAVE
      {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
      NAME[4]";IN$:IF IN$=N$
      {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
      {RVS}T{OFF}APE OR {RVS}
      D{OFF}ISK: [4]";
FP 730 GET A$:IF A$="T"THEN PR
      INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
      ,15,"I0:":B=EA-SA:IN$="
      0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
      OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
      H*256):PRINT#1,CHR$(AL)
      ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
      R$(PEEK(BS+I));:IF ST T
      HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
      O940
GS 800 GOSUB1060:PRINT"{DOWN}
      {BLK}ERROR DURING SAVE:
      [4]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
      OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
      $)+256*ASC(B$+Z$):IF AD
      <>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
      OKE BS+I,ASC(A$+Z$):IF(
      I<>B)AND ST THEN F=2:AD
      =I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
      >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
       CLOSE1:CLOSE15:GOSUB10
      60:PRINT"{RVS}ERROR: "A
      $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
      187,PEEK(FA+3):POKE188,
      PEEK(FA+4):IFOP=0THEN92
      0
HJ 890 SYS 63466:IF(PEEK(783)A
      ND1)THEN GOSUB1060:PRIN
      T"{DOWN}{RVS} FILE NOT
      {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
      30):IF AD<>SA THEN F=1:
      GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
      2)-1:F=F-2*(A<EA)-3*(A>
      EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
      OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
      UB1010:ON OP GOTO950:SY
      S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
       SAVE COMPLETED **":GOT
      O220
XP 950 POKE147,0:SYS 63562:IF
      {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
       LOAD COMPLETED **":GOT
      O220
DP 970 GOSUB1060:PRINT"{BLK}
      {RVS}ERROR DURING LOAD:
      {DOWN}[4]":ON F GOSUB98
      0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
      G ADDRESS (";:GOSUB360:
      PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
      AD=SA+AD:GOSUB360:PRINT
       D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
      ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
      *256):POKE193,AL:POKE1
      94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
      *256):POKE174,AL:POKE1
      75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
      1050
HA 1040 IF(AD>511 AND AD<40960
```

```
        )OR(AD>49151 AND AD<53
        248)THEN GOSUB1080:F=0
        :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
        {SPACE}INVALID ADDRESS
        {DOWN}{BLK}":F=1:RETU
        RN
AR 1060 POKE SD+5,31:POKE SD+6
        ,208:POKE SD,240:POKE
        {SPACE}SD+1,4:POKE SD+
        4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
        TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
        240:POKE SD,0:POKE SD+
        1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
        KE SD+4,0:POKE SD,0:PO
        KE SD+1,0:RETURN
```

Program 2: MLX For Commodore 128

```
AE 100 TRAP 960:POKE 4627,128:
       DIM NL$,A(7)
XP 110 Z2=2:Z4=254:Z5=255:Z6=2
       56:Z7=127:BS=256*PEEK(4
       627):EA=65280
FB 120 BE$=CHR$(7):RT$=CHR$(13
       ):DL$=CHR$(20):SP$=CHR$
       (32):LF$=CHR$(157)
KE 130 DEF FNHB(A)=INT(A/256):
       DEF FNLB(A)=A-FNHB(A)*2
       56:DEF FNAD(A)=PEEK(A)+
       256*PEEK(A+1)
JB 140 KEY 1,"A":KEY 3,"B":KEY
        5,"C":KEY 7,"D":VOL 15
       :IF RGR(0)=5 THEN FAST
FJ 150 PRINT"{CLR}"CHR$(142);C
       HR$(8):COLOR 0,15:COLOR
        4,15:COLOR 6,15
GQ 160 PRINT TAB(12)"{RED}
       {RVS}{2 SPACES}{9 @}
       {2 SPACES}"RT$;TAB(12)"
       {RVS}{2 SPACES}{OFF}
       {BLU} 128 MLX {RED}
       {RVS}{2 SPACES}"RT$;TAB
       (12)"{RVS}{13 SPACES}
       {BLU}"
FE 170 PRINT"{2 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {2 DOWN}"
DK 180 PRINT"{BLK}STARTING ADD
       RESS{4}";:GOSUB 260:IF
       {SPACE}AD THEN SA=AD:EL
       SE 180
FH 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS{4}";:GOSUB
        260:IF AD THEN EA=AD:E
       LSE 190
MF 200 PRINT"{DOWN}{BLK}CLEAR
       {SPACE}WORKSPACE [Y/N]?
       {4}":GETKEY A$:IF A$<>"
       Y" THEN 220
QH 210 PRINT"{DOWN}{BLU}WORKIN
       G...";:BANK 0:FOR A=BS
       {SPACE}TO BS+(EA-SA)+7:
       POKE A,0:NEXT A:PRINT"D
       ONE"
DC 220 PRINT TAB(10)"{DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU {4}{DOWN}":
       PRINT TAB(13)"{RVS}E
       {OFF}NTER DATA"RT$;TAB(
       13)"{RVS}D{OFF}ISPLAY D
       ATA"RT$;TAB(13)"{RVS}L
       {OFF}OAD FILE"
HB 230 PRINT TAB(13)"{RVS}S
       {OFF}AVE FILE"RT$;TAB(1
       3)"{RVS}C{OFF}ATALOG DI
       SK"RT$;TAB(13)"{RVS}Q
       {OFF}UIT{DOWN}{BLK}"
AP 240 GETKEY A$:A=INSTR("EDLS
       CQ",A$):ON A GOTO 340,5
       50,640,650,930,940:GOSU
       B 950:GOTO 240
SX 250 PRINT"STARTING AT";:GOS
       UB 260:IF(AD<>0)OR(A$=N
       L$)THEN RETURN:ELSE 250
BG 260 A$=NL$:INPUT A$:IF LEN(
       A$)=4 THEN AD=DEC(A$)
PP 270 IF AD=0 THEN BEGIN:IF A
       $<>NL$ THEN 300:ELSE RE
       TURN:BEND
MA 280 IF AD<SA OR AD>EA THEN
       {SPACE}300
PM 290 IF AD>511 AND AD<65280
       {SPACE}THEN PRINT BE$;:
       RETURN
SQ 300 GOSUB 950:PRINT"{RVS} I
       NVALID ADDRESS {DOWN}
       {BLK}":AD=0:RETURN
RD 310 CK=FNHB(AD):CK=AD-Z4*CK
       +Z5*(CK>Z7):GOTO 330
DD 320 CK=CK*Z2+Z5*(CK>Z7)+A
AH 330 CK=CK+Z5*(CK>Z5):RETURN
QD 340 PRINT BE$;"{RVS} ENTER
       {SPACE}DATA ":GOSUB 250
       :IF A$=NL$ THEN 220
JA 350 BANK 0:PRINT:F=0:OPEN 3
       ,3
BR 360 GOSUB 310:PRINT HEX$(AD
       )+":";:IF F THEN PRINT
       {SPACE}L$:PRINT"{UP}
       {5 RIGHT}";
QA 370 FOR I=0 TO 24 STEP 3:B$
       =SP$:FOR J=1 TO 2:IF F
       {SPACE}THEN B$=MID$(L$,
       I+J,1)
PS 380 PRINT"{RVS}"B$+LF$;:IF
       {SPACE}I<24 THEN PRINT"
       {OFF}";
RC 390 GETKEY A$:IF (A$>"/" AN
       D A$<":") OR(A$>"@" AND
        A$<"G") THEN 470
AC 400 IF A$="+" THEN A$="E":G
       OTO 470
QB 410 IF A$="-" THEN A$="F":G
       OTO 470
FB 420 IF A$=RT$ AND ((I=0) AN
       D (J=1) OR F) THEN PRIN
       T B$;:J=2:NEXT:I=24:GOT
       O 480
RD 430 IF A$="{HOME}" THEN PRI
       NT B$:J=2:NEXT:I=24:NEX
       T:F=0:GOTO 360
XB 440 IF (A$="{RIGHT}") AND F
        THEN PRINT B$+LF$;:GOT
       O 470
JP 450 IF A$<>LF$ AND A$<>DL$
       {SPACE}OR ((I=0) AND (J
       =1)) THEN GOSUB 950:GOT
       O 390
PS 460 A$=LF$+SP$+LF$:PRINT B$
       +LF$;:J=2-J:IF J THEN P
       RINT LF$;:I=I-3
GB 470 PRINT A$;:NEXT J:PRINT
       {SPACE}SP$;
HA 480 NEXT I:PRINT:PRINT"{UP}
       {5 RIGHT}";:L$="
       {27 SPACES}"
DP 490 FOR I=1 TO 25 STEP 3:GE
       T#3,A$,B$:IF A$=SP$ THE
       N I=25:NEXT:CLOSE 3:GOT
       O 220
BA 500 A$=A$+B$:A=DEC(A$):MID$
       (L$,I,2)=A$:IF I<25 THE
       N GOSUB 320:A(I/3)=A:GE
       T#3,A$
AR 510 NEXT I:IF A<>CK THEN GO
       SUB 950:PRINT:PRINT"
       {RVS} ERROR: REENTER LI
       NE ":F=1:GOTO 360
DX 520 PRINT BE$:B=BS+AD-SA:FO
       R I=0 TO 7:POKE B+I,A(I
       ):NEXT I
XB 530 F=0:AD=AD+8:IF AD<=EA T
       HEN 360
CA 540 CLOSE 3:PRINT"{DOWN}
       {BLU}** END OF ENTRY **
       {BLK}{2 DOWN}":GOTO 650
MC 550 PRINT BE$;"{CLR}{DOWN}
       {RVS} DISPLAY DATA ":GO
       SUB 250:IF A$=NL$ THEN
       {SPACE}220
JF 560 BANK 0:PRINT"{DOWN}
       {BLU}PRESS: {RVS}SPACE
       {OFF} TO PAUSE, {RVS}RE
       TURN{OFF} TO BREAK{4}
       {DOWN}"
XA 570 PRINT HEX$(AD)+":";:GOS
       UB 310:B=BS+AD-SA
DJ 580 FOR I=B TO B+7:A=PEEK(I
       ):PRINT RIGHT$(HEX$(A),
       2);SP$;:GOSUB 320:NEXT
       {SPACE}I
XB 590 PRINT"{RVS}";RIGHT$(HEX
       $(CK),2)
GR 600 F=1:AD=AD+8:IF AD>EA TH
       EN PRINT"{BLU}** END OF
        DATA **":GOTO 220
EB 610 GET A$:IF A$=RT$ THEN P
       RINT BE$:GOTO 220
QK 620 IF A$=SP$ THEN F=F+1:PR
       INT BE$;
XS 630 ON F GOTO 570,610,570
RF 640 PRINT BE$"{DOWN}{RVS} L
       OAD DATA ":OP=1:GOTO 66
       0
BP 650 PRINT BE$"{DOWN}{RVS} S
       AVE FILE ":OP=0
DM 660 F=0:F$=NL$:INPUT"FILENA
       ME{4}";F$:IF F$=NL$ THE
       N 220
PF 665 IF LEN(F$)>14 THEN 660
RF 670 PRINT"{DOWN}{BLK}{RVS}T
       {OFF}APE OR {RVS}D{OFF}
       ISK: {4}";
SQ 680 GETKEY A$:IF A$="T" THE
       N 850:ELSE IF A$<>"D" T
       HEN 680
SP 690 PRINT"DISK{DOWN}":IF OP
        THEN 760
EH 700 DOPEN#1,(F$+",P"),W:IF
       {SPACE}DS THEN A$=D$:GO
       TO 740
JH 710 BANK 0:POKE BS-2,FNLB(S
       A):POKE BS-1,FNHB(SA):P
       RINT"SAVING ";F$:PRINT
MC 720 FOR A=BS-2 TO BS+EA-SA:
       PRINT#1,CHR$(PEEK(A));:
       IF ST THEN A$="DISK WRI
       TE ERROR":GOTO 750
GC 730 NEXT A:CLOSE 1:PRINT"
       {BLU}** SAVE COMPLETED
       {SPACE}WITHOUT ERRORS *
       *":GOTO 220
RA 740 IF DS=63 THEN BEGIN:CLO
       SE 1:INPUT"{BLK}REPLACE
        EXISTING FILE [Y/N]{4}
       ";A$:IF A$="Y" THEN SCR
       ATCH(F$):PRINT:GOTO 700
       :ELSE PRINT"{BLK}":GOTO
        660:BEND
GA 750 CLOSE 1:GOSUB 950:PRINT
       "{BLK}{RVS} ERROR DURIN
       G SAVE: {4}":PRINT A$:G
       OTO 220
FD 760 DOPEN#1,(F$+",P"):IF DS
        THEN A$=DS$:F=4:CLOSE
       {SPACE}1:GOTO 790
```

3 TECHNICAL PROGRAMS

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Subject to: $X_2 < 10$
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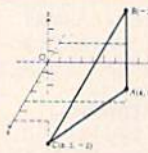

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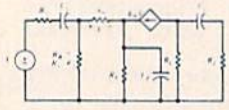

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```
PX 770 GET#1,A$,B$:CLOSE 1:AD=
       ASC(A$)+256*ASC(B$):IF
       {SPACE}AD<>SA THEN F=1:
       GOTO 790
KB 780 PRINT"LOADING ";F$:PRIN
       T:BLOAD(F$),B0,P(BS):AD
       =SA+FNAD(174)-BS-1:F=-2
       *(AD<EA)-3*(AD>EA)
RQ 790 IF F THEN 800:ELSE PRIN
       T"{BLU}** LOAD COMPLETE
       D WITHOUT ERRORS **":GO
       TO 220
ER 800 GOSUB 950:PRINT"{BLK}
       {RVS} ERROR DURING LOAD
       : {4}":ON F GOSUB 810,8
       20,830,840:GOTO220
QJ 810 PRINT"INCORRECT STARTIN
       G ADDRESS (";HEX$(AD);"
       )":RETURN
DP 820 PRINT"LOAD ENDED AT ";H
       EX$(AD):RETURN
EB 830 PRINT"TRUNCATED AT ENDI
       NG ADDRESS ("HEX$(EA)")
       ":RETURN
FP 840 PRINT"DISK ERROR ";A$:R
       ETURN
KS 850 PRINT"TAPE":AD=POINTER(
       F$):BANK 1:A=PEEK(AD):A
       L=PEEK(AD+1):AH=PEEK(AD
       +2)
XX 860 BANK 15:SYS DEC("FF68")
       ,0,1:SYS DEC("FFBA"),1,
       1,0:SYS DEC("FFBD"),A,A
       L,AH:SYS DEC("FF90"),12
       8:IF OP THEN 890
FG 870 PRINT:A=SA:B=EA+1:GOSUB
        920:SYS DEC("E919"),3:
       PRINT"SAVING ";F$
AB 880 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("EA18"):
       PRINT"{DOWN}{BLU}** TAP
       E SAVE COMPLETED **":GO
       TO 220
CP 890 SYS DEC("E99A"):PRINT:I
       F PEEK(2816)=5 THEN GOS
       UB 950:PRINT"{DOWN}
       {BLK}{RVS} FILE NOT FOU
       ND ":GOTO 220
GQ 900 PRINT"LOADING ...{DOWN}
       ":AD=FNAD(2817):IF AD<>
       SA THEN F=1:GOTO 800:EL
       SE AD=FNAD(2819)-1:F=-2
       *(AD<EA)-3*(AD>EA)
JD 910 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("E9FB"):
       IF ST>0 THEN 800:ELSE 7
       90
XB 920 POKE193,FNLB(A):POKE194
       ,FNHB(A):POKE 174,FNLB(
       B):POKE 175,FNHB(B):RET
       URN
CP 930 CATALOG:PRINT"{DOWN}
       {BLU}** PRESS ANY KEY F
       OR MENU **":GETKEY A$:G
       OTO 220
MM 940 PRINT BE$"{RVS} QUIT
       {4}";RT$;"ARE YOU SURE
       {SPACE}[Y/N]?":GETKEY A
       $:IF A$<>"Y" THEN 220:E
       LSE PRINT"{CLR}":BANK 1
       5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE
       N RESUME 300
MK 970 IF ER=14 AND EL=500 THE
       N RESUME NEXT
KJ 980 IF ER=4 AND EL=780 THEN
        F=4:A$=DS$:RESUME 800
DQ 990 IF ER=30 THEN RESUME:EL
       SE PRINT ERR$(ER);" ERR
       OR IN LINE";EL
```

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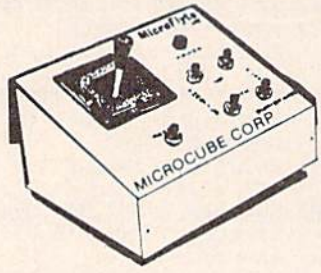

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The Automatic Proofreader

Philip I. Nelson

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, and 16 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP- RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, and 65526 for the Plus/4 and 16). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
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Please enclose an SASE if you wish to have the materials returned.

Articles are reviewed within four weeks of submission.

How To Type In COMPUTE!'s Gazette Programs

Each month, COMPUTE!'s Gazette publishes programs for the Commodore 128, 64, Plus/4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then on, erasing what was in memory. So be sure to *save a program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the *Gazette*, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

When You Read:	Press:	See:
[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

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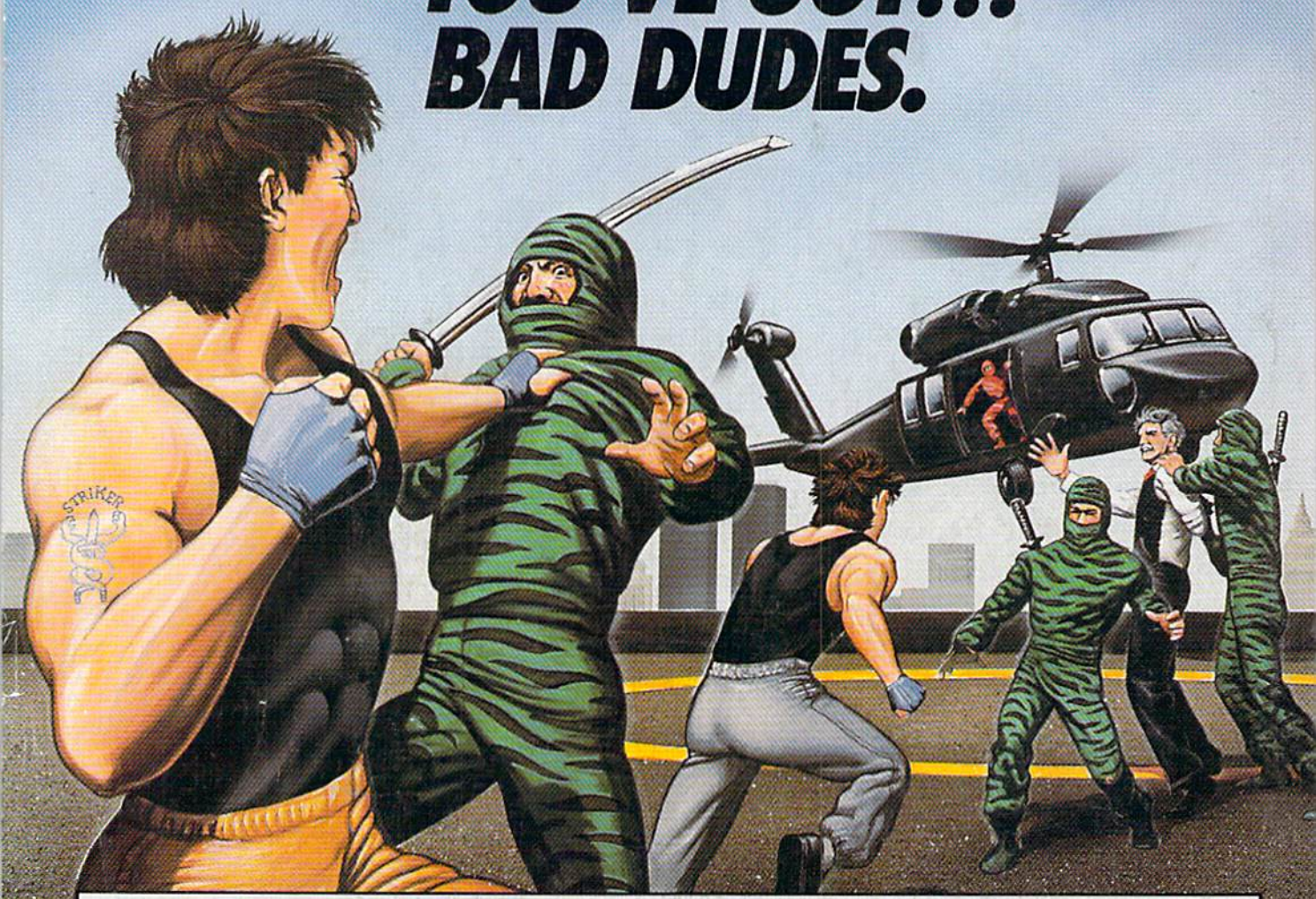

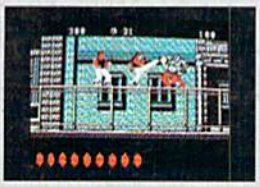

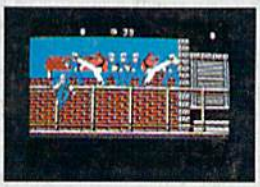

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